APPLIED HYDRAULICS

JULY 1955

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

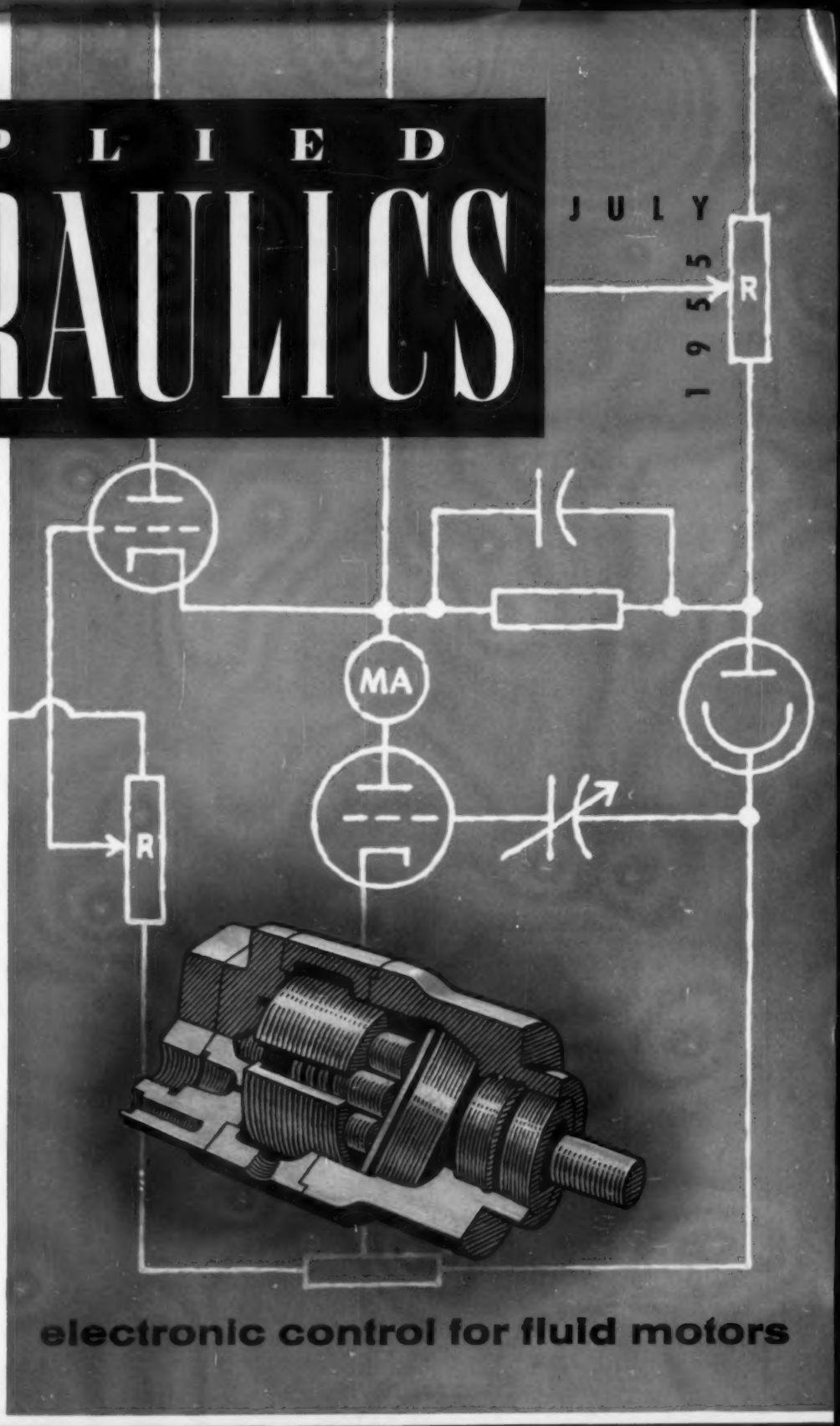
High Speed Pump and Motor Design . . . page 57

Changing to Fire-resistant Fluid? . . . page 66

How to Unload a Pump's Full Volume . . . page 70

Eliminate Slip and Compression Effects . . . page 74

Fabricating Machinery Hydraulics . . . page 94



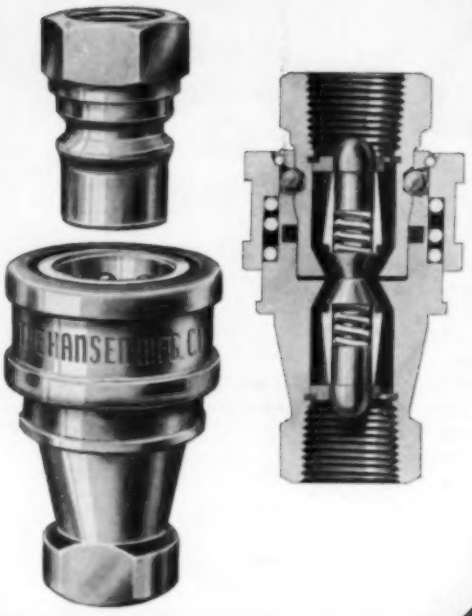
electronic control for fluid motors

FRANCHISE CIRCULATION

For information about
THE MASTER CATALOG OF FLUID POWER PRODUCTS
see page 113

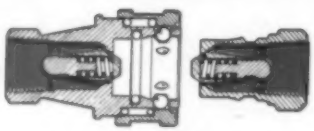
HANSEN

QUICK-CONNECTIVE 2-WAY SHUT-OFF COUPLINGS!



QUICK CONNECTION AND DISCONNECTION

INSTANT AUTOMATIC FLOW OR SHUT-OFF



Seals Both Ends of Line
AUTOMATICALLY INSTANTANEOUSLY

Quick Connective Fluid Line Couplings for
AIR • OIL • GREASE • HYDRAULIC FLUIDS • REFRIGERANTS • STEAM VACUUM • OXYGEN • ACETYLENE GASOLINE • COOLANTS • WATER

HOSE CLAMPS • HOSE CLAMP PLUGS • HOSE CLAMP SOCKETS HOSE CLAMP COUPLINGS • AIR LIQUID SPRAY GUNS • AIR BLOW GUNS • SAND BLAST CLEANERS ENGINE CLEANERS

To connect a Hansen Two-Way Shut-Off Coupling, you just pull back the sleeve and push the Plug into the Socket. To disconnect, merely pull back sleeve. No tools required. Similar valves in Socket and Plug shut off both ends of line when Coupling is disconnected—practically eliminate spilling of liquid or escape of gas at instant of disconnection.

FEMALE PIPE THREAD CONNECTIONS FROM ⅛″ TO 1″

Hansen Series HK Two-Way Shut-Off Couplings are available with female pipe thread connections from ⅛″ to 1″ inclusive. Available in brass or steel.

Also Straight-Through and One-Way Shut-Off Couplings. Write for Catalog.

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FEATURES YOU WILL LIKE:

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- Resistance to corrosion throughout.
- Positive sealing with minimum friction loss.
- Materials selected for strength, durability and long cylinder life.
- Interchangeable heads and mountings.
- Conformation to J.I.C. Standards.
- Automatic compensation for rod packing wear.
- Built-in piston rod scraper to prevent dirt and abrasives from scoring rod or damaging packings.
- Adjustable cushions of unique design.
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The New HANNA T 750 Series Fluid Power CYLINDERS

● You'll find some unique and very interesting operating features in these new Hanna **T750** Series Fluid Power Cylinders . . . features that will help you solve many of your cylinder application problems more easily and more simply. The new Hanna **T750** Series comes in a range of capacities, sizes and mounting styles—for air operation up to 250 psi and hydraulic operation up to 750 psi.

For details, ask your Hanna Representative (see your classified telephone directory), or write today for a copy of the new **T750** Fluid Power Cylinder Catalog. No obligation.

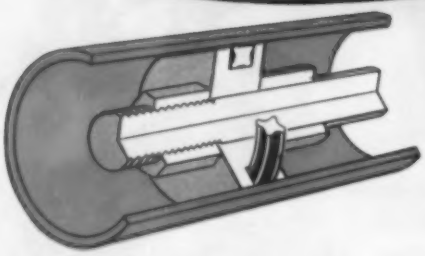
NEW CATALOG
Write for Catalog 750A—it gives complete details.

Hanna Engineering Works

1741 Elston Avenue, Chicago 22, Illinois

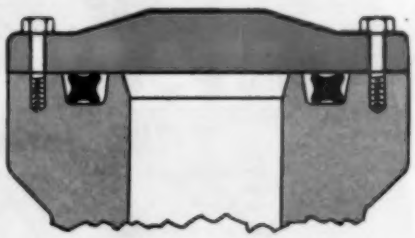
QUAD RINGS®

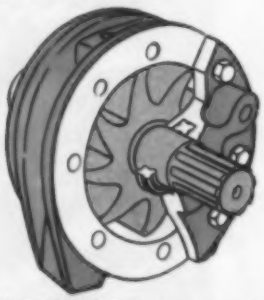
Revolutionary new hydraulic seal



1. PACKING for reciprocating motion in hydraulic and pneumatic devices. New design eliminates "spiral twist," a common cause for packing failure. Users have reported *much less drag and breakaway* in installations where QUAD RINGS have replaced O-Rings and other types of packing. Leading edge of QUAD RING acts as a wiper ring to minimize abrasion and prolong service life. QUAD RINGS form a *positive seal* under a wide range of pressures—are particularly efficient at 0 to 5 psi. Where O-Rings and other packings fail in performance, try QUAD RINGS.

2. GASKETS for sealing matching metal parts. The unique design of QUAD RINGS prevents excessive distortion under pressure and prolongs the life of the gasket. The four lips of the seal prevent "by pass" in devices using frequent pressure cycles. There is less "working action" of the gasket in the groove permitting a rougher groove finish. QUAD RING gaskets are made in a complete range of sizes corresponding in dimensions with O-ring gaskets—making them completely interchangeable with O-ring gaskets, eliminating any conversion costs.





3. ROTARY SEALS where hydraulic sealing is required on revolving shafts. Although QUAD RINGS are limited to moderate pressures, field reports show many successful applications of QUAD RINGS on rotating devices. The minimum friction of QUAD RINGS permit much higher rotation speed and longer service life.

QUAD RINGS are an exclusive product of Minnesota Rubber and Gasket Company—and the result of intensive research and field testing for 2 years. Minnesota Rubber, the nation's foremost producer of O-rings, V cups, U seals and custom molded parts, understands the problems of modern industrial design. As originators of modern injection rubber molding, Minnesota Rubber produces QUAD RINGS—and all its many other rubber parts—to the closest possible dimensional tolerances.

Free samples of QUAD RINGS are available in all sizes together with a descriptive brochure with technical information and installation data. We urge you to inquire about this revolutionary new seal today.

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APPLIED HYDRAULICS

VOLUME 8 NUMBER 7

JULY 1955

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BPA

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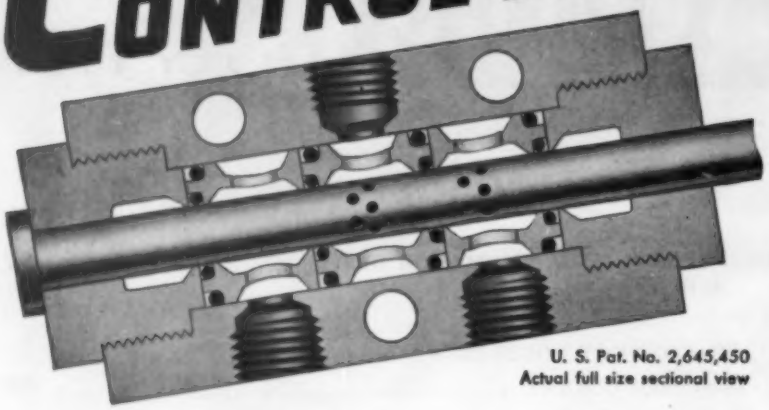
NEW, INEXPENSIVE, HIGHLY EFFICIENT

Quick-As-Wink® CONTROL VALVE

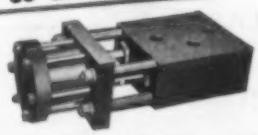


U. S. Pat. No. 2,645,450
Actual full size sectional view

COMBINES greatly simplified construction, positive positioning of all parts, and quick and easy repacking in the field.

• Internal spacers are held firmly and accurately in metal to metal end abutment when the gland nuts are tightened, holding the "O" rings in correct position, without subjecting them to any mechanical pressure. Flow is from the inlet chamber through the hollow, radially ported, stainless steel plunger, and out the connected line. No direct impingement of flow across the packings, greatly prolonging their life. ⅛" or ¼" pipe connections. 2, 3, 4 or 5-way actions. Push-pull; push, spring return; lever; foot; cam; pilot; diaphragm and single and double solenoid designs. Write for Bulletin No. 531 today! *It gives full details.*

Ask us also about...



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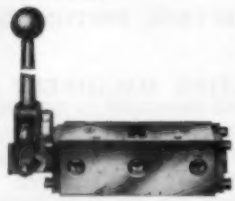

SINGLE PLUNGER AIR VALVE, 3/8" to 1½" sizes. Widely used for controlling single and double acting cylinders and as pilots for other valves

Quick-As-Wink AIR AND HYDRAULIC Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

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APPLIED

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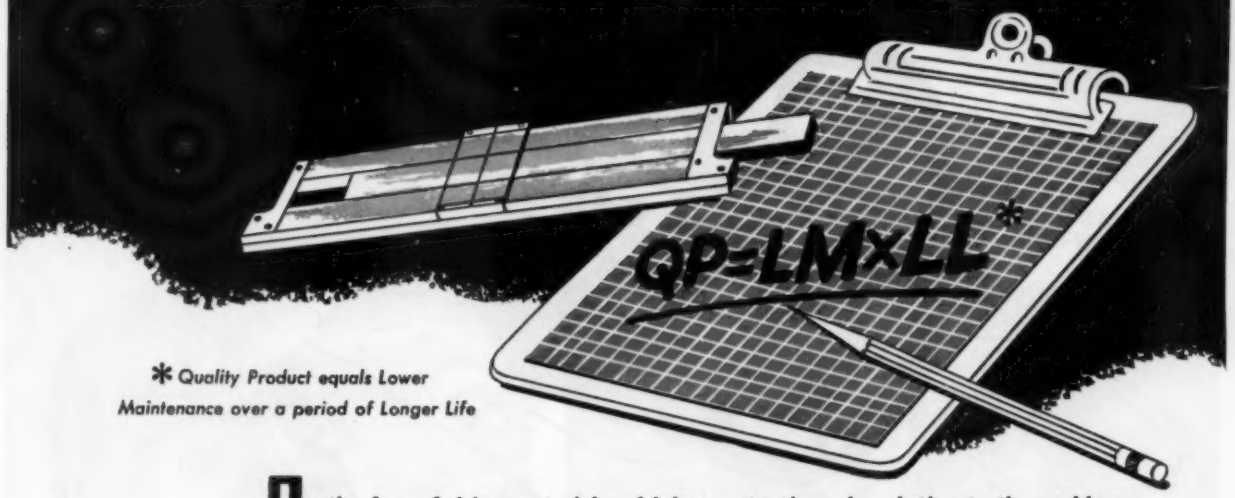
Gerotor Offers the Basic Equation for Reduced Maintenance Costs...

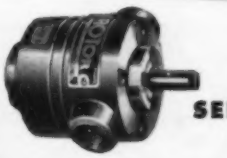


** Quality Product equals Lower Maintenance over a period of Longer Life*

On the face of rising material and labor costs, the only solution to the problem of keeping pace is to reduce production costs. A basic factor in cost reduction is the minimizing of maintenance and repair costs and the elimination of "down time" on your production line. The initial step in this solution is to include QUALITY products as original equipment in your machine designs.

The name GEROTOR is synonymous with QUALITY in the field of hydraulics.

GEROTOR HYDRAULIC PUMPS and MOTORS, designed into your hydraulic systems, assure lower maintenance cost over a longer life. There is a standard Gerotor pump to meet your requirements!



SERIES "QDB"

g.p.m. .4 to 1.5

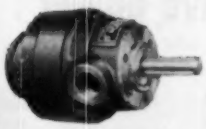
PRESSURE—Maximum continuous operating pressure to 1000 p.s.i.

SPEED—Standard design speed is 1800 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

MOUNTING—Standard mountings are plain (weight 6½ lbs.), base (weight 8¼ lbs.) and flange (weight 9 lbs.).



SERIES "QDH"

g.p.m. 3 to 12

PRESSURE—Maximum continuous operating pressure is 1200 p.s.i., maximum intermittent 1500 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is also available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

MOUNTING—Standard mountings are plain (weight 28 lbs.), base (weight 32 lbs.) and flange (weight 31 lbs.).

SERIES "O"

g.p.m. 20 to 40

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i., except for type O-40, which is recommended for only intermittent duty at 1000 p.s.i. and 700 p.s.i. continuous.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

MOUNTING—Standard mountings are plain (weight 46 lbs.), base (weight 55 lbs.) and flange (weight 58 lbs.).

The GEROTOR engineers can help you solve your hydraulic pump problems. Write for *free* literature and full particulars.

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Manufacturers of—

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Looking for a more efficient piston design?

. . . These Johns-Manville Custom-Moulded Packing cups increase piston efficiency . . . save space . . . save power . . . serve longer

TYPE A . . . The Type "A" J-M Moulded Packing Cup is the "standard" for use on the pistons of pumps and on various hydraulic and pneumatic mechanisms. The lip forms a tight seal under discharge pressure, but relaxes on the reverse stroke, reducing friction and conserving power.

TYPE B . . . This type of cup is essentially the same as Type A, except that the leading edge of the lip is square instead of beveled. This construction provides greater strength where the lip may be exposed to distortion or excessive wear due to openings in cylinder walls.

Johns-Manville Moulded Packing Cups can help you improve piston designs. They provide a highly efficient seal . . . improve equipment performance . . . lower operating and maintenance costs. These custom-made packings are extensively used on all types of slow moving pistons and rams operating under high or low pressures and temperatures.

Johns-Manville Moulded Packing Cups may be used on practically all air or hydraulic-operated cylinders. For instance, those which are in such equipment as reciprocating pumps, hydraulic jacks and presses, pneumatic chucks, governors, lift trucks, grease guns, valves, drilling and boring machinery . . . or on any other equipment where efficient piston design is essential.

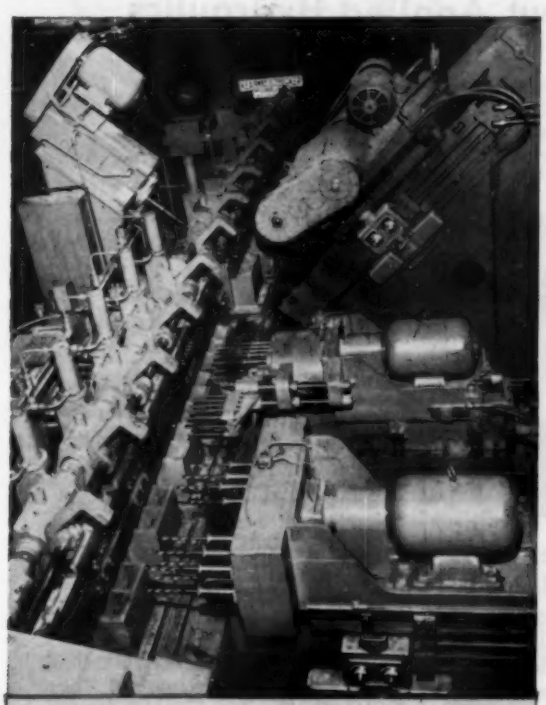
You have your choice of a number of styles and compositions of these precision-moulded cups to meet temperatures and pressures encountered in hydraulically operated equipment. Types "A" and "B," shown here, are most widely used on inside-packed pistons with the outside edge or lip contacting the cylinder wall or liner. Other types are available, however, for other services.

If you would like more information on these or other types of Johns-Manville Custom-Made Piston Packings, get in touch with your Johns-Manville Packings Distributor, or write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

VICKERS HYDRAULICS Helps Cut Costs at PACKARD . . . *on Wide Variety of Jobs in New V-8 Engine Plant*

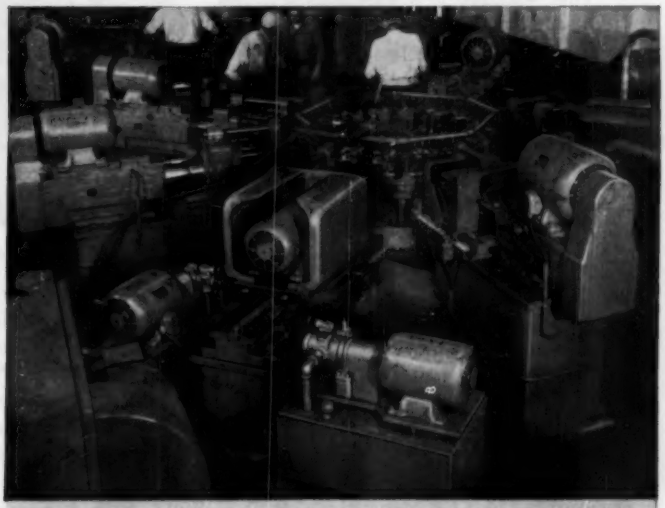


Kearney & Trecker machine for drilling and counterboring bearing caps. Note Vickers Traverse and Feed Cycle Control Panels visible on two heads; advantages include smooth and constant feed rates, easy adjustability, compactness and simplified installation.

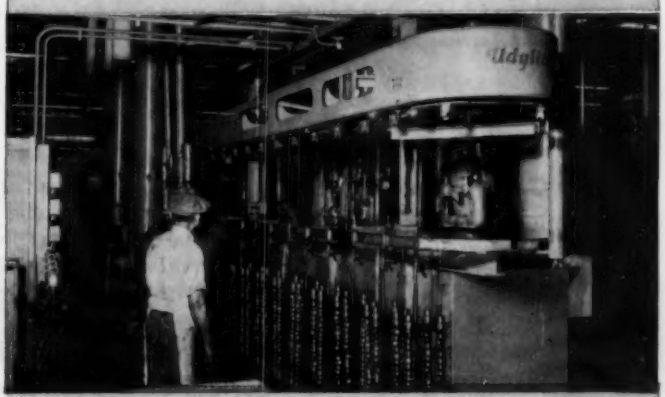
Three Greenlee Transfer Machines in automatized cylinder block line use Vickers Hydraulics. Compact Vickers Traverse and Feed Cycle Control Panel shown on head assures smooth and constant feed rate regardless of fluctuations in tool resistance or changes in hydraulic pressure or volume.

Representative of the many and varied production machines equipped with Vickers Hydraulics in the new Packard V-8 Engine Plant at Utica, Michigan are those shown here. Among the advantages of Vickers Hydraulics are: (1) simplification of design, (2) adaptable to automation, (3) ease of providing interlocks and overload protection, (4) ease of maintenance with minimum down time. Equally important, Vickers Hydraulics gives you the benefits of a nation-wide and full-time field engineering and service organization.

The Vickers Application Engineer near you will be glad to show you the benefits you can obtain by using Vickers Hydraulics. Write for a copy of Bulletin 5002.



Michigan Drill Head Co. 8 station dial machine for connecting rods and caps. Vickers Hydraulic Power Units shown are complete hydraulic "packages" (pump, electric motor, valves, oil reservoir, filter, etc.) that simplify design, and save installation and maintenance costs.



Udylite Automatic Processing Machine saves space and assures more uniform quality by using Vickers Hydraulics to raise, lower and transfer cam shafts through cleaning, coating and rinsing baths in "Lubriting" process.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Fluid Power Lines

about Applied Hydraulics

"It's a darn good paint remover"

That was the first comment of a maintenance man who was asked what he thought of the new fire-resistant fluid he recently put into a machine. Of course, that's not the most impressive thing about fire-resistant fluids. Ask a safety engineer and he'll say, "This fluid has minimized the fire hazard." Ask a shop superintendent and he might say, "We've got some awfully expensive leaks now."

All this brings us to Russ Hemeon's article which tells how Ternstedt-Trenton Division of General Motors goes about changing over a machine from petroleum base to fire-resistant fluids. Their procedure has paid off in reduced operating and maintenance costs plus less loss due to leakage.

Russ has given several slide-illustrated lectures on the practical application of hydraulics. In 1953 and '54, he participated in the National Conference on Industrial Hydraulics, and last November he spoke before a joint meeting of the ASME and ASLE in Philadelphia. His information is based on extensive experience which has been recorded on charts and photographs.

J. R. Hemeon

Work with fire-resistant fluids led Russ to develop methods for evaluating different fluids. Next month he'll tell you about one important selection factor—component service life.

Color Control

Printing a page which has several colors requires accurate control of the printing to prevent any unwanted overlap of colors. This control is called register. It's a very precision operation. Color register on many jobs has to be held within .005 of an inch. Take a look at a color ad and you'll quickly see what is meant by register.

Accuracy requirements for registering color are as severe as you will find in any industry. Consequently, the control circuits on multi-color presses are carefully engineered. Hydraulic drives play a vital part. Robert Booth details a control for a six color press in his article.

Higher Speeds

Dick Marvin tells about development work on high speed transmissions, in this month's lead article. To reduce unit weight and space and get more horsepower per pound, higher speeds instead of higher pressures were attempted. Bearing design is the main consideration. Dick describes some of the approaches to attaining greater bearing life at high speeds.

Does the Pump Really Unload?

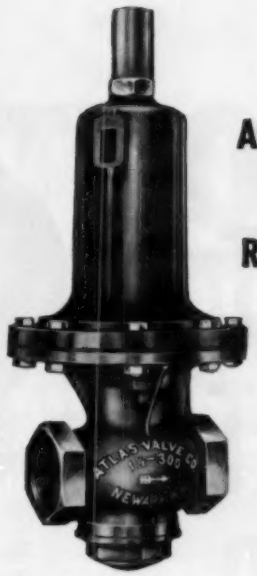
When pump delivery is bypassed back to tank through an unloading valve, pressure of the bypassing oil should be close to zero. In a circuit where a pump must be unloaded after an accumulator is charged, reliable unloading by hydraulic actuation of the unloading valve is tough to do. Don Tingley and Fred Dahlman of Corning Glass told us about their unloading circuit between sessions at the NCIH meeting last year. We prevailed on them to make some sketches to show you how a special valve simplifies the circuit piping.

Don Tingley left, and Fred Dahlman meet between sessions of the National Conference on Industrial Hydraulics.

If you are using a similar circuit, the next time you're out in the shop put your hand on the unloading valve. If the valve is hot, the circuits on page 70 will help reduce your power costs and increase the life of your equipment.

sealed **TIGHT,**
sealed **RIGHT,**
with a **Precision "O" Ring!**

. . . this Atlas Reducing Valve

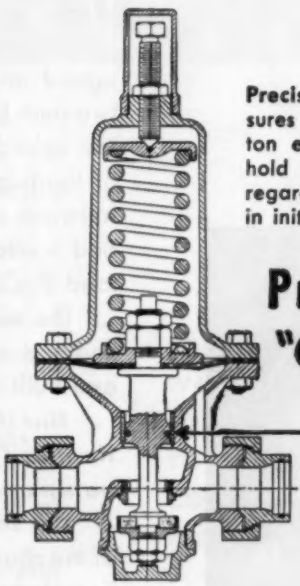


Atlas Fig. 191—Type "E" Reducing Valve

The Atlas Valve Co., Newark, N. J., has developed its Fig. 191-Type "E" Reducing Valve for initial pressures to 300 PSI, and reduced pressures from 5 to 125 PSI, on water, air or oil service. For a positive seal on the piston—less friction, better and longer service life at higher temperatures — Atlas Engineers specify **Precision** "O" Rings.

How about your sealing problem? Let our engineers help you solve it with **Precision** "O" Rings—tough, compression molded, rigidly inspected—finest "O" Rings made!

FREE—Handbook of "O" Ring data.
Write for yours today.



Precision "O" Ring assures tight seal on piston enabling valve to hold reduced pressure regardless of changes in initial pressure.

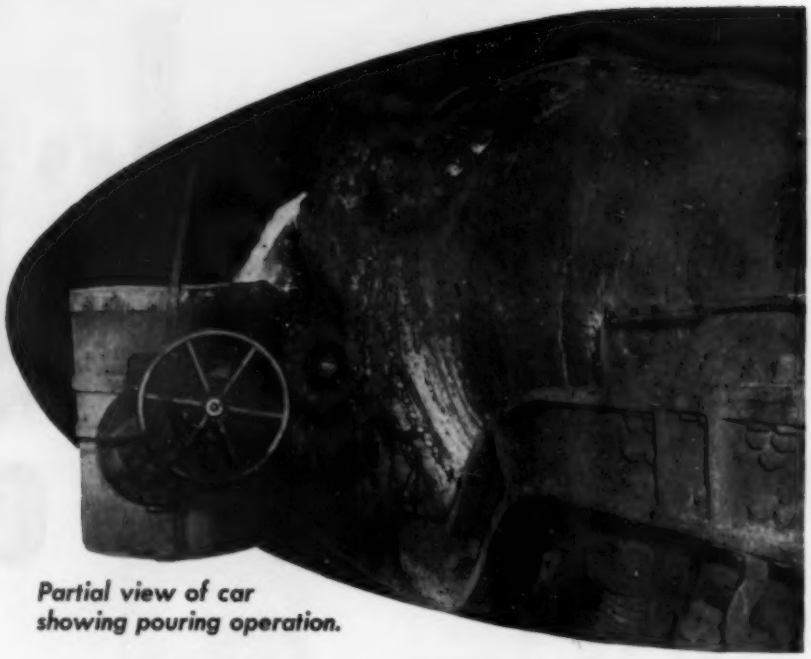
Precision "O" Ring

Precision Rubber Products CORPORATION

"O" Ring and Dyna-seal® Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio **Canadian Plant at: Ste. Thérèse de Blainville, Québec**

This is a HOT METAL CAR



Partial view of car showing pouring operation.

It contains 90 tons of molten iron which is poured into 5 ton ladles, as needed to serve a casting floor in Jones & Laughlin's Pittsburgh Works. To pour this iron from the car requires a force of 180 tons.

This operation is performed hydraulically by equipment designed and built by Benjamin Lassman & Son. The operator uses two push buttons, one for raising and one for lowering the car body. The speeds of pouring and returning are equal and independent of loading and oil viscosity changes due to temperature extremes between summer and winter. The response of the system must be, and is smooth and shock free, even on reversal of motion, and the load can be indefinitely sustained in any position.

The movement and control of large masses dictates the use of heavy duty components, and all those used here we have designed and built accordingly.

But the really unusual thing about this particular Lassman-designed-system is that the hydraulic circuit comprises only a pump and two check valves!

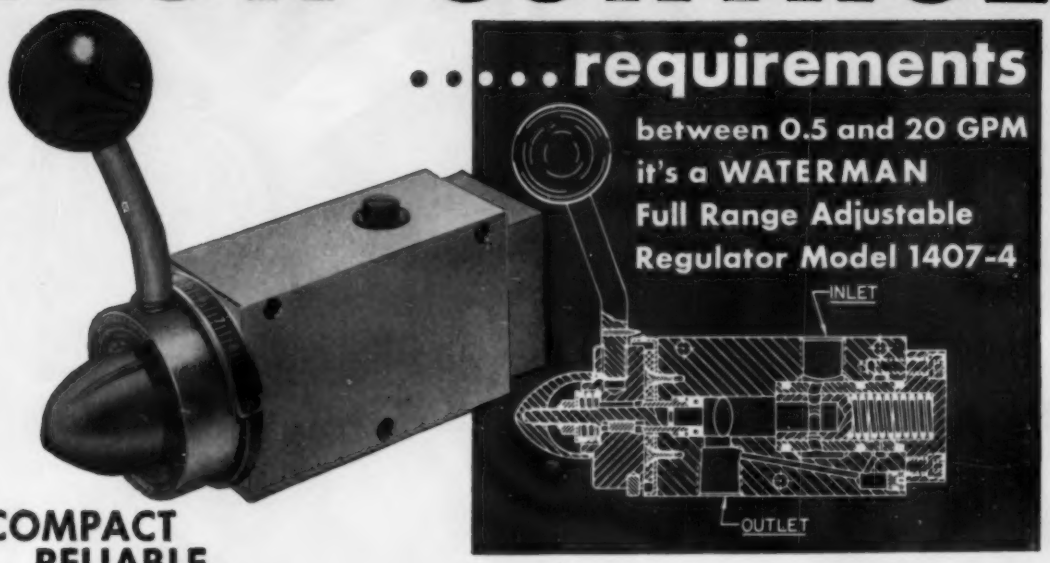
The simplicity and reliability of this installation is an example of the character of engineering design that is inherent in our hydraulic systems, and the high quality of our equipment is your guarantee of quality performance. We would be pleased to work with you on your hydraulic applications and to show you the advantages of control and operation that we can offer you.

A close-up of the arm engaging the car body.

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.

FOR YOUR
FLOW CONTROL



COMPACT
RELIABLE
RUGGED

- Minimum to maximum flow adjustment obtained by 180° handle rotation.
- Flow rate changes easily accomplished under any conditions of pressure or back pressure.
- Adjustable handle tension eliminates need for wrenches and locking levers for changes in flow setting.
- Ideally suited for installations requiring frequent changes in operating speeds or throttling control during the machine cycle.
- Choice of control—either right or left rotation of control handle.
- Multiple control—with right and left hand rotation operator can control two operations simultaneously.
- Aluminum bodies housing steel working parts provide light weight units for easy handling and installation.

LOOK TO WATERMAN FOR THE ANSWER TO YOUR FLOW CONTROL REQUIREMENTS

Write for latest illustrated bulletin A

WATERMAN
ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

PULL IT . . . TWIST IT . . . STRETCH IT

Bonded IPC Packings Stay Bonded

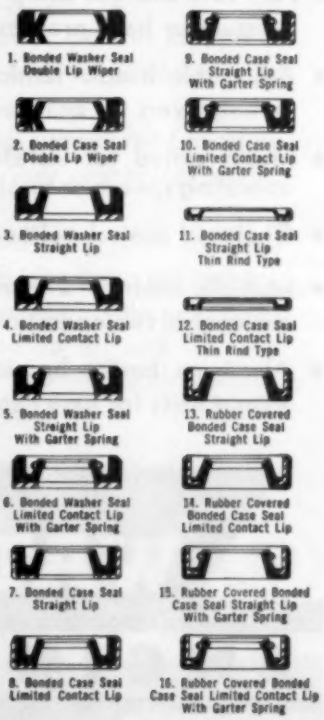
Here's proof that "Bonded by IPC" means absolute adhesion . . . rubber to metal. Exerting more stress would only result in bending the metal case, or in tearing the synthetic rubber, but the IPC bond between will not break down.

Case seals and bonded washer seals will probably never face such grueling strain in actual use . . . but the fact remains . . . they could.

Whatever your sealing problem, you can rely on IPC packings. They will be custom designed and IPC experience assures low cost dependability.

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire


1. Bonded Washer Seal Double Lip Wiper
2. Bonded Case Seal Double Lip Wiper
3. Bonded Washer Seal Straight Lip
4. Bonded Washer Seal Limited Contact Lip
5. Bonded Washer Seal Straight Lip With Garter Spring
6. Bonded Washer Seal Limited Contact Lip With Garter Spring
7. Bonded Case Seal Straight Lip
8. Bonded Case Seal Limited Contact Lip
9. Bonded Case Seal Straight Lip With Garter Spring
10. Bonded Case Seal Limited Contact Lip With Garter Spring
11. Bonded Case Seal Straight Lip Thin Rind Type
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
13. Rubber Covered Bonded Case Seal Straight Lip
14. Rubber Covered Bonded Case Seal Limited Contact Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

P4

faster dis-assembly | no re-alignment problems

O-M has the KEY to simpler cylinder maintenance

O-M Cylinders save down-time expense and headaches when it comes time to replace packing and seals. SPECIAL INTERNAL LOCKING KEY is released by rotating end cover, which allows quick, easy removal of cover and rod. And re-assembly is fool-proof. There's only one way to take an O-M Cylinder apart, one way to put it together. Key controls positioning . . . locks cover securely. No threads to strip. No tie rods and end caps to bolt together. No time-consuming alignment and adjustment problems.

O-M Air and Hydraulic Cylinders are available in a complete range of sizes (1½ to 8" bores), with standard, 2 to 1 or oversize rods. All steel construction with bearing bronze. Completely interchangeable parts. *Immediate delivery on many sizes.*

fit where others won't

mail coupon now!

for FREE catalog, complete set of ½-scale templates, showing all cylinders, mounts and mounting brackets.

ORTMAN-MILLER MACHINE COMPANY
1 143rd Street, Hammond, Indiana

☐ Have representative call ☐ Send latest catalog ☐ Send ½-scale templates

Name_____ Position_____

Company_____

Address_____

City_____ Zone____ State_____

BRIEFS

about fluid power

PNEUMATICS SOLVES ROLL PRESSURE PROBLEM

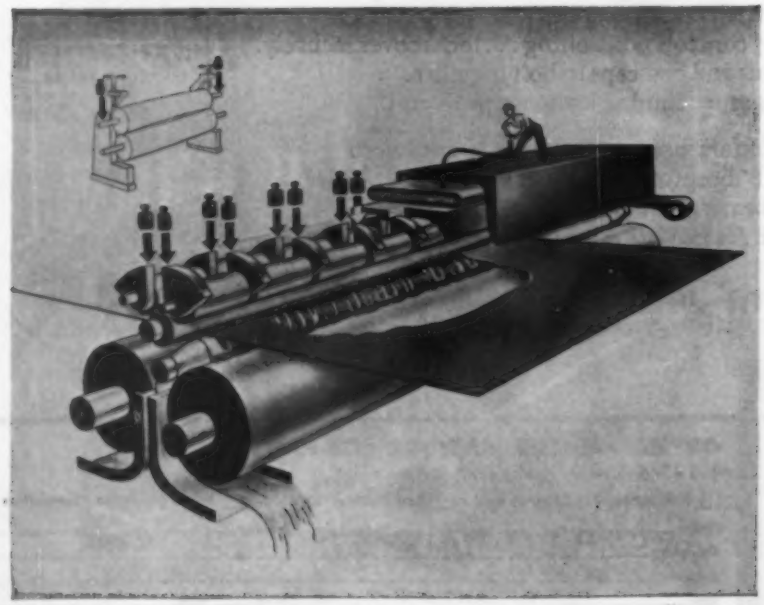
A pneumatic loading system as the most practical medium for exerting a controlled, resilient load on squeeze rolls, has solved many dyehouse problems, where accurately controlled pressure is a must. Rodney Hunt Machine Company has engineered a pneumatic mangle design combining all features which assure uniform pressure when processing fabrics.

Previously, to effect desired loading, the weight-and-lever method or turning a handwheel against a stiff spring were used. As squeeze rolls were usually loaded at their journals, and due to the applied load, the top roll would reflect upward the lower roll sag, resulting in a gap at the center nip.

The new pressure system consists of an inflated tube or "air bag" confined in a rigid transverse channel, and transmitting its evenly distributed pressure through a flexible steel plate bearing against the self-adjusting brackets to staggered, short-face pressure rolls. These apply their evenly distributed forces to the small diameter, stainless steel top nip roll. The lower nip roll, cradled between two heavy support rolls has a minimum deflection and permits the stainless steel roll and the pressure system to conform to the soft upper roll.

This pneumatic system produces a maximum loading of 250 pounds per lineal inch at 43 psi air pressure.

▼▼▼



Packing Material For Petroleum And Fire-Resistant Fluids

A new synthetic compound which will find its principal use in the hydraulic packings field, has been developed by Monsanto Chemical Company's Organic Chemical Division.

Packings made from this material, designated Vyram, will permit the use of petroleum and fire-resistant fluids. As a replacement packing it will equip present systems for easy conversion from one fluid to another. The new product, an acrylate-type elastomer, can be fabricated into standard packings and gaskets using conventional processing equipment.

The material, still classed as a development product, is the outcome of two years joint research in the field of synthetic functional fluids and synthetic elastomers.

▼▼▼

Portable Hydraulic Testing Machine

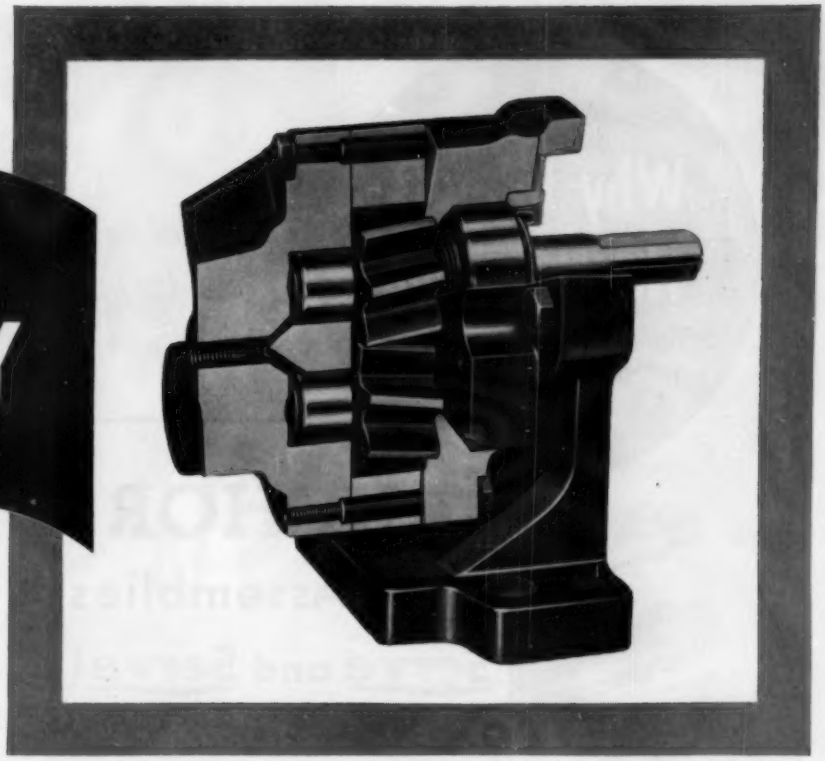
To meet testing requirements of the Argonne National Laboratory, Baldwin-Lima-Hamilton Corporation developed a unit of 60,000 pound capacity in tension and compression.

A double-acting hydraulic capsule is used in the weighing system which is separate and independent of the hydraulic loading system. The null-balance indicator on the control unit has three

Continued on page 16

These
QUALITY
Features

make
WEBSTER



YOUR BEST BUY
in Gear-Type Hydraulic Pumps

Moderately priced, the complete line of WEBSTER Positive Displacement Gear-Type Hydraulic pumps combines compact, adaptable designs with quality construction features which pay off in rugged, dependable operation. For example:

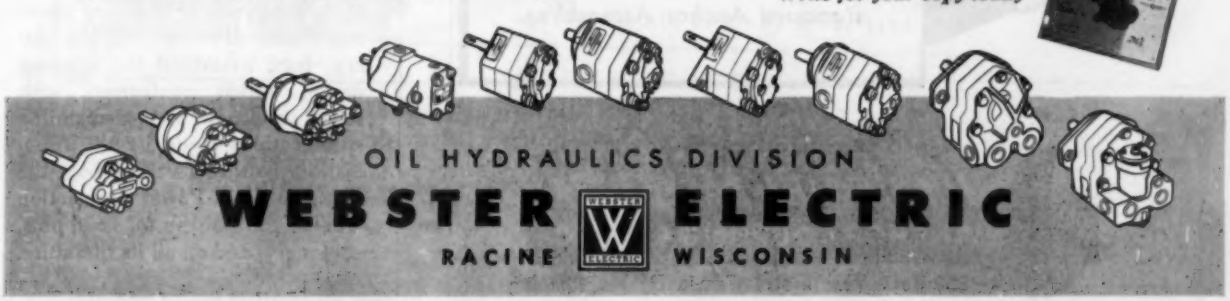
- Heavy-duty needle bearings withstand overloads. Anti-friction bearings throughout assure high mechanical efficiency.
- Temperature and oil resistant synthetic lip seal.
- Smooth running helical gears of alloy steel are precision made and properly hardened for quiet operation, long life.
- Double-row ball bearings absorb compound driving thrusts.
- Standard external seal drain permits use in either rotation. Internal drain can be furnished if desired.
- Pump cover is available with either end or side ports.
- Standard two-bolt S.A.E. magneto mount. Other mountings available.

Available in capacities from 1/5 to 30 GPM, for pressures up to 1500 psi, speeds to 3600 RPM. More than 100 different models to meet the widest possible range of requirements.

Application Engineering Service

WEBSTER's trained Hydraulic Engineers are immediately available to assist you in your pump application problems, without cost or obligation. Just drop us a line.

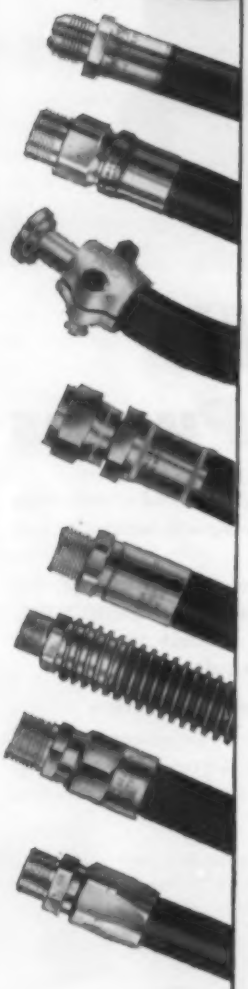
***FREE 12-PAGE CATALOG** contains complete information on the WEBSTER line of Pumps and Hydraulic Motors.*
Write for your copy today



OIL HYDRAULICS DIVISION
WEBSTER ELECTRIC
RACINE WISCONSIN

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY

Why tolerate Hose Trouble when –



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Hose Assemblies Serve and Serve!

Who said so?

Our customers—those who have reason to KNOW. Right here is where you can begin to profit by forming your own opinion based on first-hand experience. First, however, let us know your problem so we can offer our many years of hose assembly experience in getting you rolling with the *right hose* and the *right couplings* for your purpose. Send us your installation data, including medium to be carried, temperatures, pressures and general specifications.

Write for our catalog describing all standard Anchor Assemblies.

ANCHOR COUPLING CO. INC.

359 North Fourth Street • Libertyville, Illinois

Branch Offices: Dallas, Tex.; Plymouth, Mich.

BRIEFS continued

ranges: 0-60,000, 0-12,000 and 0-2,400 pounds.

Two 24 inch stroke double-acting cylinders apply the loads between the side columns, which also

serve as thick walled tubes through which oil is fed to and from the loading cylinders. A small flexible tube between the movable crosshead and the frame is used for transmitting weighing pressure.

The testing and control units can be mounted on casters, and the testing machine can be operated as far as 25 feet from the control unit.

▼▼▼

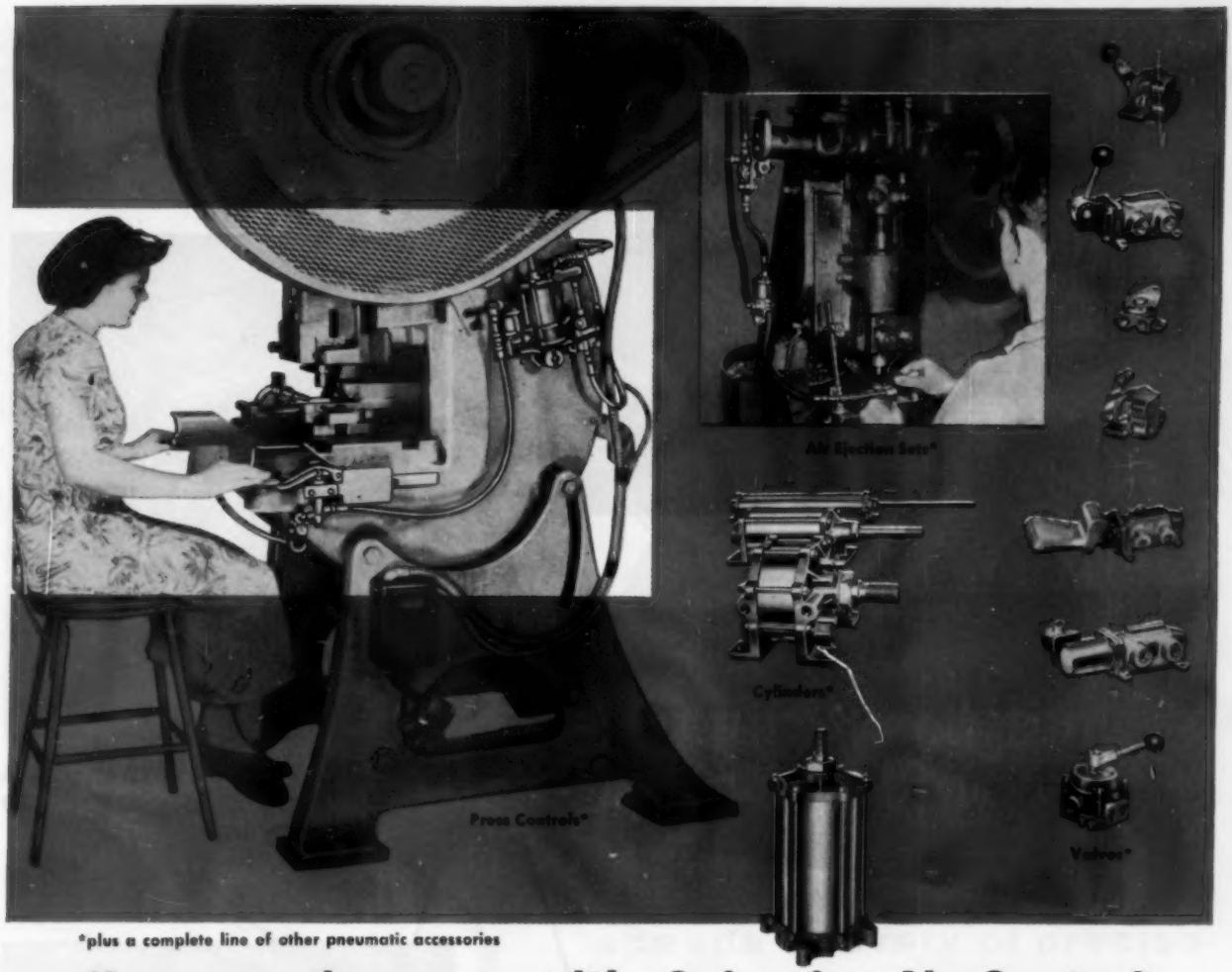
Emblem for National Fluid Power Association

From the many designs submitted, the National Fluid Power Association selected this emblem

at their recently held spring meeting. Racine Hydraulics & Machinery, Inc., submitted the winning design which conformed with seven unusual and demanding specifications made by the Association. Now in its third year, the National Fluid Power Association will use the emblem for lapel pins, stationery, and on all its literature.

▼▼▼

Continued on page 20



*plus a complete line of other pneumatic accessories

Harness air power with Schrader Air Control

On many machines, Schrader Control Sets will actually double your production by replacing tedious, time-wasting manual operations with swift, safe, sure movement by air. In other locations, Schrader Valves, Cylinders and other Air Line Accessories lift... lower... pull... push... clamp... clean off. They do many things so easily and quickly that you'll find it hard to believe you did without them before.

Take a look around your plant—keeping in mind where air power could do the job better. Then let us help you develop your ideas into neat, efficient air line hookups that will pay for themselves over and over again the first year. For specific information, write —or, if you prefer, fill out the convenient coupon below.

Schrader
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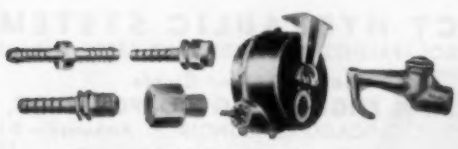
LEADERS IN AIR CONTROL SINCE 1844



The complete Schrader line of pneumatic accessories includes everything you need

A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
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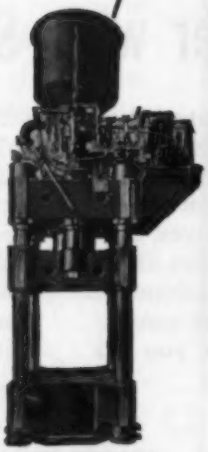
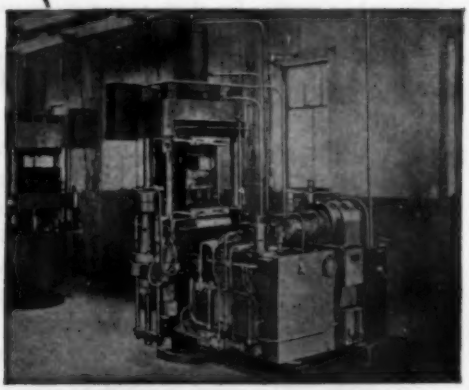
All over N.America you will find
ELECTRAULIC HIGH SPEED PUMPS
AND AUTODRAULIC CONTROL VALVES

BIRDSBORO PRESS PRODUCING CORRUGATED ROOFING.

All over North America Electraulic All-Hydraulic high speed pumps and Autodraulic control valves are giving consistent and unfailing performance over a wide range of applications. A direct hydraulic system powered by Electraulic pumps and operated by an Autodraulic control system (no solenoids) is an independent unit, unaffected by the demands of other machines, giving any desired pressure at fingertip control—it cannot fail to give increased efficiency and economy in your plant.



HYMAC PULP BALING PRESS



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ELECTRAULIC
REGD. TRADE MARK
HIGH SPEED PUMPS

DIRECT HYDRAULIC SYSTEM
TOWLER BROS (PATENTS) LTD. RODLEY. NR. LEEDS. ENGLAND.
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AUTOMATION, the "push button" by-word of modern production, is now applied to the manufacture of "O" Rings. LINEAR'S new high-speed ROTO-MOLDING process produces true compression-molded quality rings at mass production rates and costs.

ROTO-MOLDING is fully automatic . . . eliminates human error. You get precisely uniform "O" Rings —every one a perfect circle, produced to your exact specifications. Moreover, ROTO-MOLDING assures rings with a tough, homogeneous grain structure, flash-free surface, and dimensional stability with improved physicals.

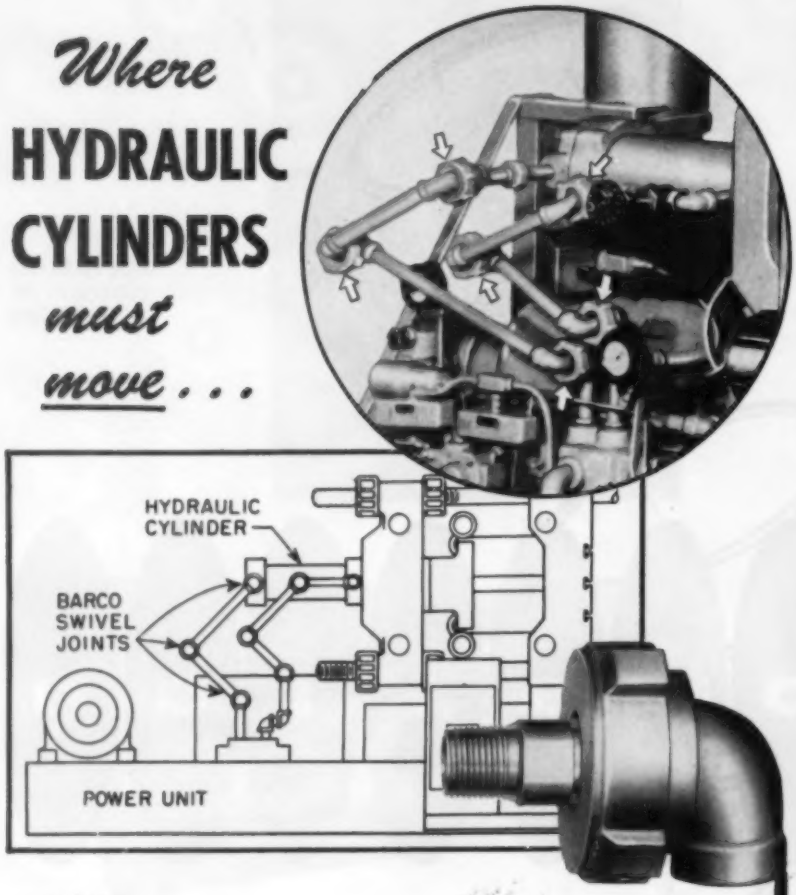
Emergency commitments of LINEAR ROTO-MOLDED "O" Rings can now be delivered in a fraction of the time previously required for premium quality rings. You can order in a wide variety of standard and special sizes and compounds, including the newest silicones. Get the facts now!

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

Where
HYDRAULIC CYLINDERS *must* ***move . . .***



Use
BARCO *Self-Aligning* **SWIVEL JOINTS**

THE Barco "Self-Aligning" Swivel Joint is one of the most useful, most versatile fittings ever developed for making flexible piping connections to moving or movable parts on injection molding presses, die casting machines, and other hydraulically operated equipment.

ENGINEERED INSTALLATIONS—Easy to position piping accurately. Put flexibility where you want it—without the nuisance of sagging, flopping, non-rigid lines. No restricted internal diameters.

BETTER CONTROL—No swelling or expansion in lines under pressure. Positive control action—no "mushiness."

PRESSURE SAFE—Barco Joints will not break or blow out suddenly. High temperature and fire resistance. Installations stay leakproof. No lubrication required.

EASY TO INSTALL—Barco's *self-aligning* feature simplifies and speeds up installation, saves time in pipe fitting, prevents binding, and minimizes wear.

Barco builds a complete line of swivel joints for every purpose. Ratings as high as 600°F., 3,000 psi (hydraulic). Sizes ⅜" to 2"; angle or straight. For complete information and recommendations, see our nearest representative or write BARCO MANUFACTURING CO., 532H Hough St., Barrington, Illinois.

HELPFUL INFORMATION:
Bulletin 265B—"Barco Swivel Joints for Piping."
Bulletin 269—"High Pressure Hydraulic Swivel Joints."

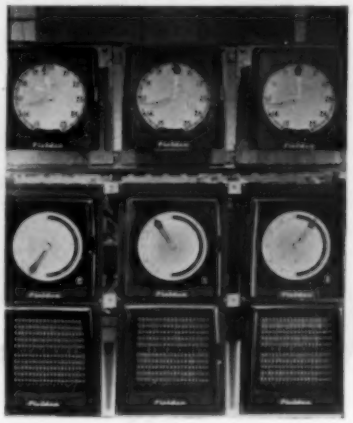
BARCO

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING, AND REVOLVING JOINTS

BRIEFS continued

Instrument Watches Many Processes

Process variables involving pressure, level, temperature, weight and many others can now be watched from a single vantage point. Fielden Instrument Division of Robertshaw-Fulton Controls Company has developed an indicating scanner which will keep a steady check



on from 6 to 48 or more steps in a manufacturing process. If one process strays beyond the pre-set control zone, scanning stops and actuates an alarm. The indicator dial will show the extent of deviation. An associated control system can automatically correct the condition. ▼▼▼

Air-Oil Unit Acts As Safety Device

To provide a means for adjusting blankholder pressure independently at all four corners of a double-action press, and also act as a safety overload protection for the blankholder, The Federal Machine and Welder Company developed a hydro-pneumatic force adjustment device.

This simple compact unit makes it possible to determine the blankholder pressure required at each corner and to duplicate this setting whenever the job is re-run. It also provides protection in case of

Continued on page 22

HYDRAULIC POWER

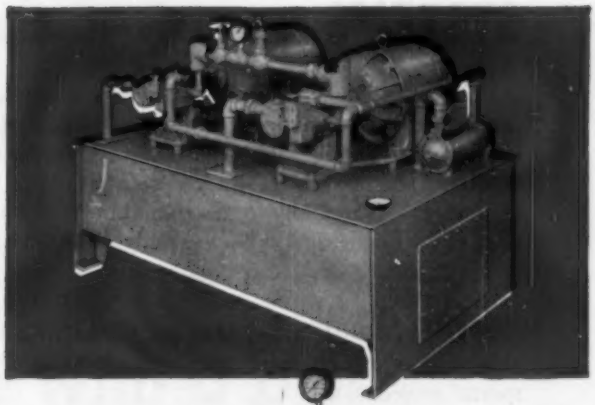
POWER UNIT MODEL SP-3054

Tank Capacity: 200 Gallons
Motors: Two 15 HP—TEFC—1200 RPM
Delivery 19.6 GPM @ 1250 PSI,
9.8 GPM @ 2000 PSI each pump
Application: Paper Making Machinery

Let Cardwell help you design and engineer the Hydraulic Power Units required for your specific job . . . write for descriptive catalog and further information.

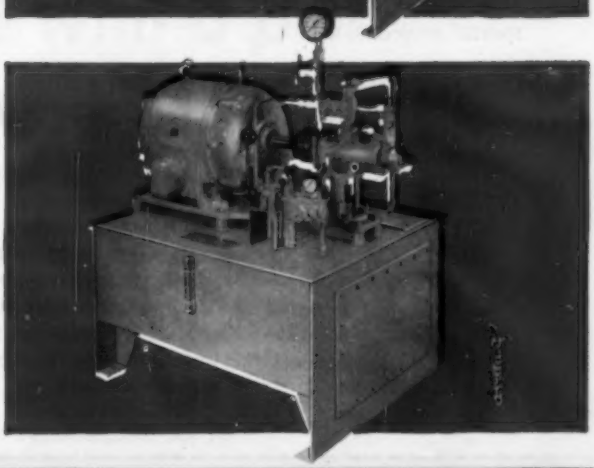
POWER UNIT MODEL SP-2954

Tank Capacity: 100 Gallons
Motor: 7½ HP—1800 RPM—TEFC
Delivery: 16 GPM @ 600 PSI
Application: Rolling Mill Machinery



TYPICAL CONTROL PANEL

Hydraulic control console for section of paper making machines. Control panel permits accurate pressure control of rolls.



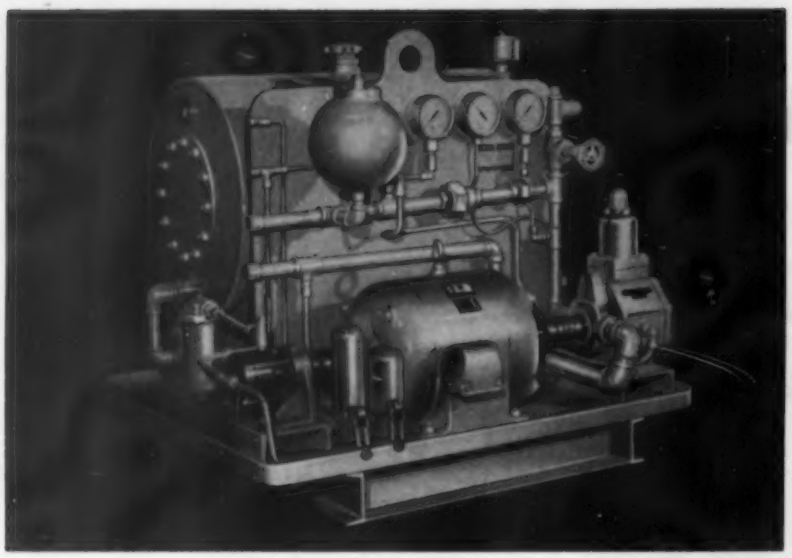
POWER UNIT MODEL SP-1254

Tank Capacity: 50 Gallons
Motor: 15 HP—1800 RPM
Delivery: 4 GPM @ 5000 PSI
Application: Missile Test Unit

CARDWELL MACHINE COMPANY

Quality A CARDWELL TRADITION SINCE 1829

Franklin at 19th St. • Richmond 11, Virginia • Phone 7-4593



Complete POWER and CONTROL SYSTEMS... *ready to connect*

SIMPLEX Engineering Company has many years of experience in co-ordinating the hydraulic principles, for all industrial applications. We have always freely utilized all types and makes of hydraulic equipment available throughout the industry. Our ability to design and build hydraulic power units of every description has enabled us to thoroughly satisfy all customer requirements, regardless of pressures, volumes, or circuits.

This vast background of hydraulic "know how" is available to all SECO *customers. We invite you to outline to us any special project.*

STANDARD *Power Package Units*

SECO

We build 26 *standard* power package units —suitable for a wide range of requirements, and ready to connect to the press or other mechanism to be operated. These *standard* units provide volumes of ½ to 10 G.P.M., and pressures from 500 to 10,000 PSI. Use the coupon below for complete information on these *standard* power and control units.

SIMPLEX ENGINEERING CO.
Zanesville, Ohio

Please send me complete information on SECO Standard power package units.

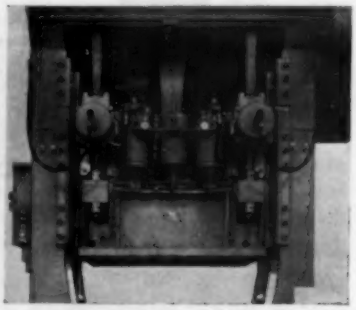
Name_____ Title_____

Company_____

Address_____

BRIEFS / continued

double blanks, as the device will detect the double blank and stop the press before damage occurs.



With the conventional rigid blankholder it was difficult to regulate blankholder pressure as this was accomplished by mechanical adjustment. ▼▼▼

Lightweight Compressed Air Container

New fiberglass containers for storing compressed air to actuate pneumatic systems on aircraft and ground service equipment have been developed by Walter Kidde & Company, Inc.

A 650 cubic inch fiberglass container (right) for 3000 psi air,

weighs only 12¼ lbs as compared to the 20½ lbs steel wire unit. The method of fabricating fiberglass spheres—by combining strands of fiberglass into a yarn, impregnated with an epoxy resin binder, the yarn then wound around a rubber liner which is finally heat cured—results in the same physical characteristics as wire-bound spheres. ▼▼▼

Continued on page 26

when packings are your problem

. . . pick the type with a plus!

You'll get many extra benefits from hydraulic operations when closer attention is given to this *plus factor:*

COMPATIBILITY between **P**ackings, **F**luids, **M**etals.

Over the years our engineers have been calling this the "P-F-M team". Every Houghton packing is made with this "team" in mind.

For a good reason, too. When packings, fluids and metals—all three—are *compatible,* hydraulic equipment serves you longer . . . maintenance is reduced . . . smooth, precision operation results.

It's a packing *plus* which the Houghton Man will be glad to discuss in more detail with you. He'll show you how standardizing on Houghton VIM and VIX-SYN Packings means:

Packings *right* for the job (we make all types and sizes)

Fluids compatible with their seals (both part of the team)

Metallurgical experience (we'll share a half-century of know-how with you)

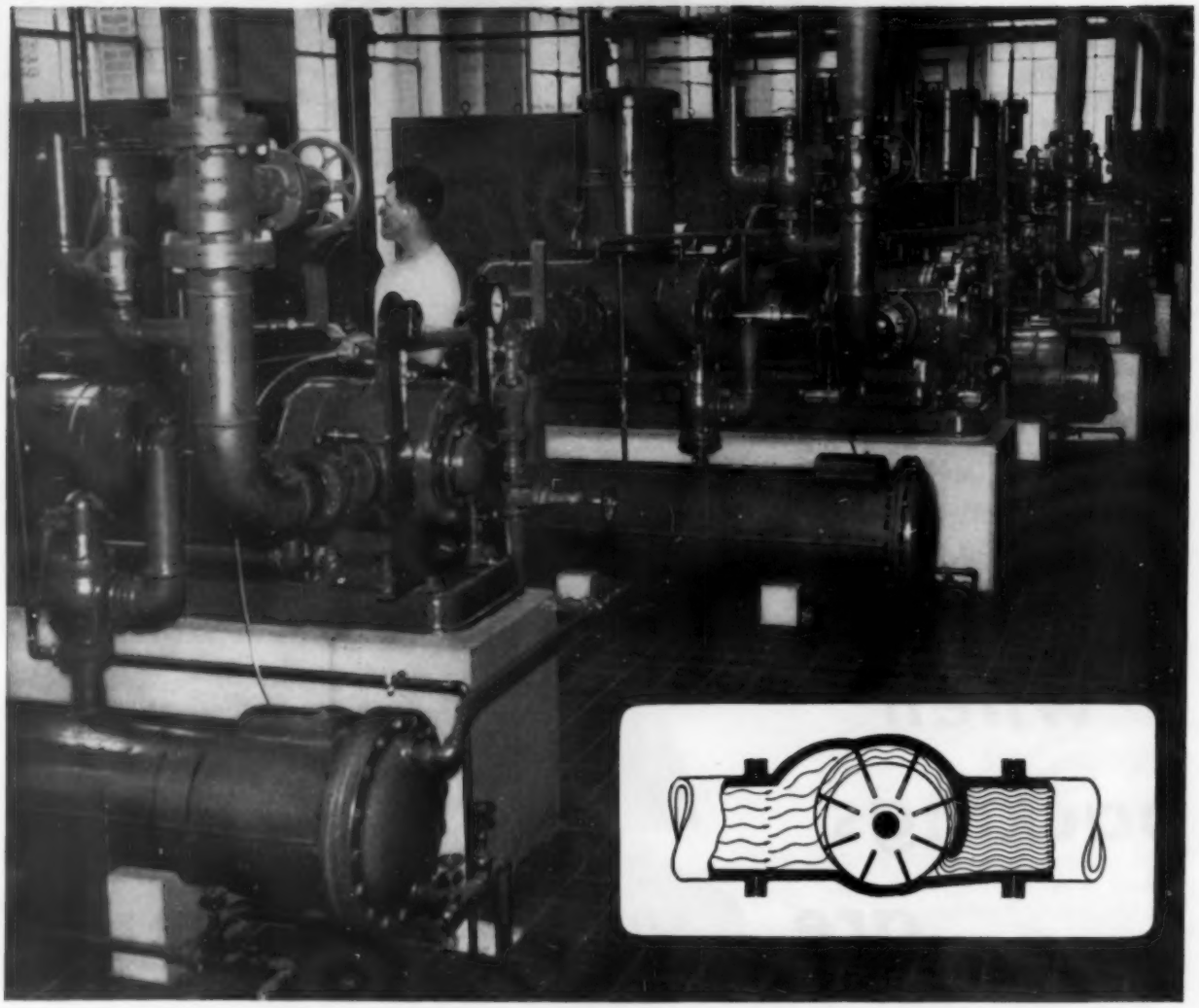
A lot of this data is in books and bulletins we'll gladly send you on request. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

VIM and VIX-SYN PACKINGS

products of . . . E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .



Industrial Pressures Up To 125 psig
Capacities to 3300 cfm

When you need such performance, it will pay you to specify Fuller vane-type Rotary Compressors. They provide the simplest, most economical and most reliable source of compressed air for all pneumatic plant services.

These compressors have a minimum number of moving parts, (rotor, blades and bearings) employ direct-connected motor drive, and operate with an incredible lack of vibration. They run for days without requiring operational attention, and are ideal for continuous service in out-of-the-way locations.

Detailed information on design characteristics, and typical applications will be forwarded promptly on request.

Fuller
. . . . pioneers in harnessing AIR

FULLER COMPANY, Catasauqua, Pa.
GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY
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C-269
1554

We're quick on the draw, too!

(especially on seamless steel tubing)

Do you need seamless steel tubing drawn quickly—and accurately—to your individual specifications? Then it'll pay you to check with Summerill before you order. *We're geared for service.*

Our research, production and sales groups are small enough to give you the kind of personal service that follows a job through from start to finish . . . and big enough to get volume production rolling in a hurry on your special tubing problems.

Our modern plant is flexible, versatile and completely equipped to produce a broad range of cold drawn seamless steel tubing in the specific sizes and shapes you need. It's laboratory controlled through every step of production to guarantee top quality products.

Why not bring your seamless steel tubing problems to Summerill today? We'll welcome the opportunity to provide you with samples, technical literature and assistance—or to work with you right in your own plant. Address: Summerill Tubing Division, Columbia Steel & Shafting Company, Pittsburgh 30, Pa.

Summerill

District Offices:

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HYDRAULIC TUBING • SPECIAL TUBING • MECHANICAL TUBING • DIESEL TUBING • PRESSURE TUBING • AIRCRAFT TUBING

Now stocked at all Garlock Branch Warehouses

CONTACT THE GARLOCK BRANCH NEAREST YOU

Yes, now you can obtain Garlock O-Rings direct from our branch warehouse nearest you. Each of our warehouses stocks 70 durometer rubber O-Rings in all popular standard sizes. For you this reduces delivery time to a minimum.

You can rely on Garlock O-Rings, too. They're made to Garlock's rigid quality standards. This means O-Rings with precise tolerances, a flash-free finish, and utmost uniformity.

For complete information, just contact your Garlock office or write for new O-Ring folder AD-148.

Baltimore, Md.
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
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Cincinnati, Ohio
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Houston, Texas
Los Angeles, Calif.
New Orleans, La.
New York, N. Y.
Palmyra, N. Y.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Ore.
Salt Lake City, Utah
San Francisco, Calif.
St. Louis, Mo.
Seattle, Wash.
Spokane, Wash.
Tulsa, Okla.

IN CANADA

Calgary, Alta.
Hamilton, Ont.
Montreal, Que.
Toronto, Ont.
Vancouver, B.C.
Winnipeg, Man.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK

BRIEFS continued

Hydraulic Vaccination

Available only for research, the Army has come up with a pistol-shaped jet injector, to replace the hypodermic needle, for assembly line mass vaccine injections. The injector is operated by a motor-driven hydraulic pump which shoots the vaccine under 250 pounds pressure. Separate triggers fire and reload the device. ▼▼▼

Precision Balancing Machine Uses Hydraulics

Snyder Tool & Engineering Co. has built this connecting rod precision balancing machine which handles a variety of heavy duty parts. The machine is made up of three individual units: a milling machine having two opposed double-spindle heads, a console containing all operating controls and a precision weighing unit. All head and fixture movements are hydraulically controlled. ▼▼▼

Fluid Power In The Mines

To make the life of the miner easier, safer and provide for higher production, manufacturers of coal mining machinery are using hydraulic and pneumatic equipment in increasing numbers. Several of these applications could be seen at the American Mining Congress and Coal Show.

One of the largest units, shown by Salem Tool Co., was a coal recovery drill which handles 42 inch diameter augurs, 24 feet long. It is hydraulically self-moving, from

Continued on page 28

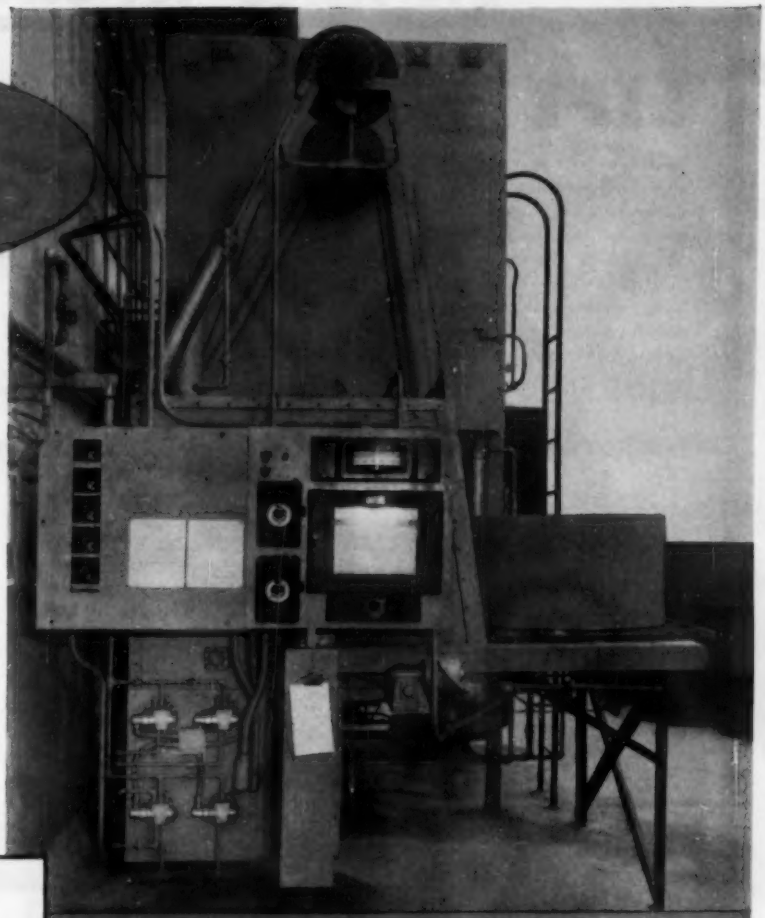
6 reasons why Modernair

TRADEMARK

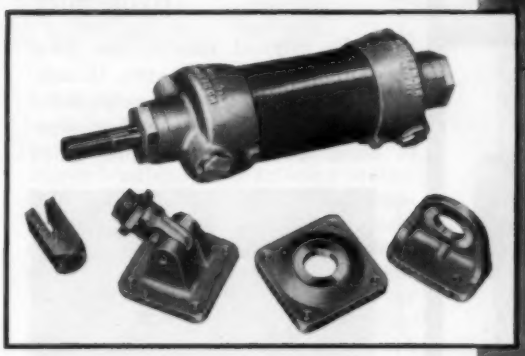
PROVENAIR
Air and Hydraulic
CYLINDERS

are easiest...

TO INSTALL
and
MAINTAIN



AUTOMATION WITH PROVENAIR CYLINDERS... California-Doran Heat Treating Co., Los Angeles, uses 4" bore PROVENAIR cylinders and MODERNAIR CV series solenoid-operated valves to operate furnace doors, move parts through fully-automatic heat treat cycle.



1. Interchangeable mountings—your choice of brackets, flange, or clevis-type swivel.
2. Heads can be rotated 360° to simplify piping.
3. Standard "O" ring seals used throughout—easy to obtain and replace.
4. Corrosion resistant; designed for safe, reliable operation on air, water or oil hydraulic systems to 400 p.s.i. in 2" and 3" bores, 200 p.s.i. in 4" and 6" bores.
5. Available in 2", 3", 4" and 6" bore sizes, any practical stroke length, in non-cushion or cushion (factory set or adjustable) types.
6. Prompt delivery of cylinders or parts from factory or dealer stocks in principal cities.

New Catalog

gives complete data and prices on MODERNAIR's full line of cylinders, valves, packaged fluid power devices. Write today for your free copy.

Modernair CORPORATION

TRADEMARK

Member of National Fluid Power Association

Dept. 7A, 400 PREDA STREET • SAN LEANDRO • CALIFORNIA

LIFT

the efficiency of your hydraulic unit with Roper dependable Pumps. Get optimum performance from the pumps that feature just two moving parts — equal size gears operating in a sturdy case with proper clearance for superior service and long life. The models shown are representative of standard Roper pumps suitable for most applications.

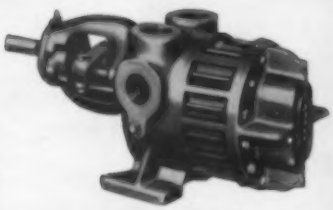
Specify
ROPER
Rotary Pumps
FOR YOUR
HYDRAULIC
APPLICATIONS

LOWER

maintenance costs with a Roper. For instance, a pump like the Series H with pressures to 1000 P.S.I., sizes 10 to 75 G.P.M. is ideally suited for hydraulic mechanisms and for other applications requiring high pressures. Spur gears run in axial hydraulic balance . . . bearings and bronze wear plates reduce friction under heavy loads. Available with packed box or mechanical seal.

PUSH

the unit in your hydraulic circuit with the correct size Roper for the particular job. In many cases the Series K will do, for it is rated from pressures to 150 P.S.I., capacities ¾ to 50 G.P.M. This model is compact, sturdy . . . is self-lubricated by liquid pumped . . . handles total suction lifts up to 25 feet. Comes with packed box or mechanical seal . . . with or without relief valve.



ROPER
Rotary Pumps

GEO. D. ROPER CORPORATION
707 Blackhawk Park Ave., Rockford, Illinois

PULL

favorable comment on a wise choice when you install a Roper as original equipment. Among the dependable Ropers is the Series F Pump — pressures to 300 P.S.I., sizes 1 to 300 G.P.M. It features four-part design with 8 optional piping arrangements . . . supplied in standard or stainless steel fitted models. With packed box or mechanical seal; with or without relief valve.

BRIEFS / continued

hole to hole, on mobile skids. The crane and all jacks, which lift 43 inches, are hydraulically operated.

Schroeder Brothers exhibited hydraulic power units for various mining machinery operations. A hydraulic hand operated coal drill, which can be powered from any hydraulic system of most universal cutting machines and roof bolting machines, eliminates hazards of sparks, shocks and kicks. For the first time the company also showed a hydraulic car spotter, a filter buggy which permits cleaning of hydraulic systems on the spot, and a portable circuit tester.

Use of hydraulic power was also seen on the many various types of roof control drills, air braking equipment and loading machines.

▼▼▼

Banking On Hydraulics

An original idea by the First National Bank of Geneva, Illinois, is paying dividends on youngsters' investments. Believing that pint-sized customers would enjoy to do

Courtesy Miller Fluid Power Co.

their own transactions at the teller's cage like grown-ups, officials of the bank, after considering several ideas, decided that it would be safest to install a hydraulic lift.

This hydraulic lift consists of a 20 inch platform with a telescop-

Continued on page 32

Circle 106 on Reader Service Card

Circle 114 on Reader Service Card

Seven years service for STANOIL Industrial Oil at David Bradley Mfg. Works —No down time for lubrication

L. R. Cummings (left), Standard lubrication specialist, inspects sample of STANOIL, with Robert C. Menken, Plant Engineer of David Bradley Manufacturing Works. Larry Cummings has been serving industrial customers for Standard Oil since graduation from Standard's Sales Engineering School. His mechanical engineering degree from Tri-State College of Indiana qualified him for this work. Customers of Larry's find this experience and background pay off for them.

David Bradley Tri-Trac, handy piece of farm equipment gives farmer new opportunity for mechanization at low cost. Upper frame on which gasoline tank is mounted, is part formed in HPM press.

Seven years ago David Bradley Mfg. Works installed 900 gallons of STANOIL Industrial Oil in an HPM press. There's been no down time required for lubrication maintenance since. A pump by-pass screen filter is the only filtering the oil receives, yet the system continues clean. In March, 1954, an analysis of the oil showed:

Viscosity @ 100° F.	— 980
Color, NPA	— 6
Neutralization No.	— .11

STANOIL Industrial Oil has long been at work for Bradley. Successful operations with it in other equipment caused Bradley engineers to specify STANOIL for this installation.

The HPM double acting, fast traverse hydraulic press reported on here is used to draw the upper frames for the David Bradley Tri-Trac, compact farm tractor. The Tri-Trac is the newest implement in the Bradley line. Bradley has been making farm implements since 1832.

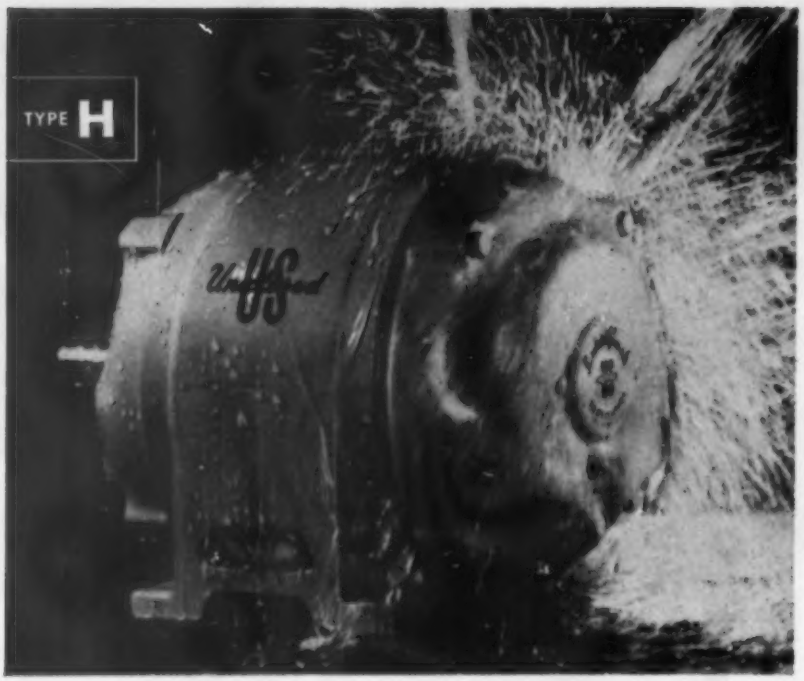
Like to know more about STANOIL? Perhaps it can serve you as efficiently as it is serving David Bradley. Lubrication specialists in any Standard Oil office will be happy to help. In the midwest, a call to one of them will bring a prompt response. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY
(Indiana)

NEW MOTOR PROTECTION

with INGENIOUS *Ventrifoil*

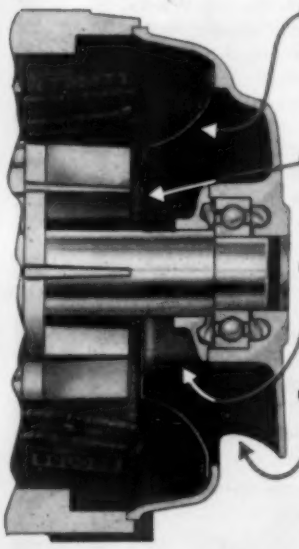


Ventrifoil

AT EACH END OF THE MOTOR DIRECTS AIR AND DEFLECTS WATER . . . Ventrifoil, a specially formed deflector, directs air around bearing housings and into fans on the rotor. By forming a "vestibule" between the bracket openings and the fan inlet, water is deflected and separated from the air stream without hindrance of the air flow to interior.

All New UNICLOSED TYPE H U. S. MOTOR

U. S. Motors new NEMA dimensioned Type H motor is an advanced development of the Uniclosed concept. In addition to Ventrifoil, Type H embodies a host of revolutionary exclusive features, such as improved asbestos-protected windings to add years to motor life; Lubriflush transverse lubrication for greatly increased bearing life; normalized castings; improved solid cast rotor; all directed to the objective of longer motor life and more efficient power.



VENTRIFOIL
Securely fastened to inside of bracket to direct air and deflect water. Does not interfere with assembly of motor.

AIR PASSAGE
Air is brought in at bottom but enters motor only through top half of deflector.

CURVED WATER FOIL
A curved projection of the Ventrifoil is concentric with the shaft and prevents entrance of water.

PROTECTED VESTIBULE
After entering bracket openings, air flows upward at low velocity through a protected chamber within bracket before reaching motor windings.

Mail Coupon for informative full-color 12-page Type H Bulletin ➧

U. S. ELECTRICAL MOTORS Inc. AH-7
P. O. Box 2058, Los Angeles 54, Calif., or
Milford, Conn. Send Type H Bulletin No. F-1856

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE___ STATE_____

U. S. MOTORS

JUST A twist OF THE wrist

That's all it takes to clean the Cuno AUTO-KLEAN—the strainer that can be continuously cleaned while it's working.

Turning the handle one revolution moves the strainer element through comb blades, removing all dirt from strainer surfaces. Dirt particles fall to bottom of housing, where they can be drained off periodically. Cuno's exclusive combing operation cleans thoroughly—without costly interruption of fluid flow.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass or stainless steel for long trouble-free service under any conditions.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 3,800 gallons per minute.

A.3.8

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

CUNO'S AUTO-KLEAN ENDS NEED FOR STAND-BY STRAINERS

Permanent strainer element saves on maintenance bills

You don't have to use a duplex strainer installation to get dirt and other solids out of your hydraulic fluids. A *single* Cuno AUTO-KLEAN strainer can do the job to your complete satisfaction.

This is possible because fluid flow doesn't have to stop while you're cleaning this strainer. Cuno's exclusive "comb-clean" action provides complete cleaning of the strainer element on the job—*without stopping fluid flow*. Thus, non-stop filtration, with no need for a stand-by strainer.

AUTO-KLEAN really cuts maintenance bills, for there aren't any cartridges to change. Occasional rotation of the handle does the cleaning job. (Most units can be equipped with motor drives for continuous cleaning.) If you want suction straining, AUTO-KLEAN is ideal. You can build it right into your sump, with the handle on the outside.

AUTO-KLEAN's low pressure drop gives full-flow filtration on gravity, low-pressure, high-pressure or suction lines—with no loss in operating efficiency. All solids larger than the specified disc spacing—from .0035" (170 mesh) to .062" (12 mesh)—are stopped by metal strainer discs. You can get standard AUTO-KLEAN filters built to operate at pressures up to 3000 psi.

Send the coupon today for free bulletin.

A.3.15

Cuno Engineering Corporation
Dept. 3515A South Vine St., Meriden, Conn.
Please send me free bulletin on Cuno AUTO-KLEAN strainers.

Name.....

Company.....

Address.....

City.....Zone....State.....

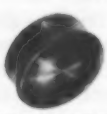
DO YOU HAVE A

PISTON SEAL PROBLEM

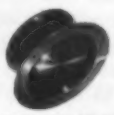
THAT Bellofram CAN SOLVE?

If your piston seal problem involves low friction losses, no leakage, high working pressures, resistance to corrosion, vibration fatigue and damage . . . Bellofram is the answer.

Bellofram—the long stroke, deep convolution constant area diaphragm which performs both bellows and diaphragm functions — offers the designer and manufacturer some *19* specific advantages as a piston seal for use in pressure sealed mechanisms. Free positioning with complete relaxation at all points within its designed stroke, the Bellofram has valuable application in *instruments* — to convert pressure into force or displacement with extreme accuracy; in *power actuators* and *motors* — to convert pressure into a long stroke at high thrust levels without mechanical friction; and as *seals* — to prevent leakage of liquid or gas across a moving piston without introducing friction or spring gradient.

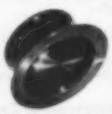


CLASS 1 FLANGELESS BEAD TYPE



CLASS 2 FLANGE TYPE NARROW CONVOLUTION

CLASS 3 BEADED-FLANGE TYPE



CLASS 4 FLANGE TYPE WIDE CONVOLUTION

Bellofram Seals are manufactured in four distinct classes, to meet the needs of a broad range of pressure sealed mechanisms. Over 300 standard sizes are available, for cylinder bores from 1″ to 6″. You also have a choice of numerous elastomer-fabric combinations, ranging from Nitrile Rubber and Nylon to Silicone Rubber and Dacron. This tremendous variety permits selection of the most *effective* Bellofram Seal for *your* application. Contact Bellofram now, for complete information on the benefits offered you by Bellofram Seals.

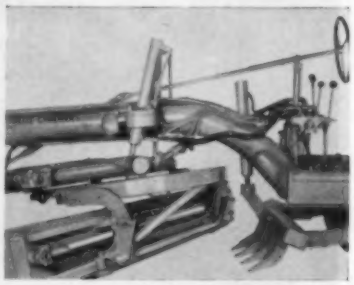
Competent Engineering Counsel Available.
Write for new Bellofram Catalog
containing Specifications, Descriptions and Application Data.

Bellofram®
CORPORATION
140 MOODY ST., WALTHAM 54, MASS.

BRIEFS continued

ing stainless steel skirt. It is raised and lowered by a hydraulic cylinder installed underneath the floor. An electric button, controlled by the teller, raises the platform to any desired height, up to the 12 inch limit of its stroke. With the platform fully lowered, and even with the floor level, it is out of the way of any grown-up. ▼▼▼

Hydraulic Moldboard For Motor Grader



This hydraulic shiftable moldboard which permits a side shift of 16 inches right or left—a total of 32 inches—was designed by The Tractor Division of the Allis-Chalmers Manufacturing Co. The blade can be shifted from the operator's seat. ▼▼▼

Booklet On Pressure Measurement

"Bibliography and Index on Dynamic Pressure Measurement" National Bureau of Standards Circular 558, compiled by W. G. Brombacher and T. W. Lashof. 124 pages, price 75 cents, available from the Government Printing Office, Washington.

References have been extensively indexed and classified by subject and author to assist the user in the task of making detailed analyses with respect to his particular interest. A bibliography of 850 items on dynamic pressure measurement and on related subject such as static pressure measurement and general information on the components of instruments are contained in this publication. ▼▼▼

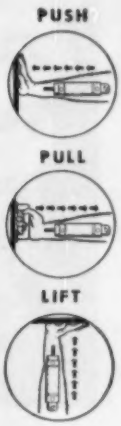
Continued on page 34

First in performance for automatic muscle jobs like these...

T-J

Spacemaker
CYLINDERS

OFF SHELF DELIVERY



- OIL pressure to 750—AIR to 200 P.S.I.
- New Compact Design . . . Saves up to 40% Space
- Proven Performance . . . with Extra High Safety Factor
- Super Cushion Flexible Seals for Air . . . New Self-Aligning Adjustable Oil Cushion
- Hard Chrome Plated Bodies and Piston Rods
- The Only Cylinders with all the Extras as Standard

T-J Spacemaker Cylinders get first call for an ever-widening range of power movement jobs in industry today—because they're so advanced in design . . . so efficient and dependable in performance. Wide selection of styles and capacities. Check your needs now! Send for bulletin SM-454-2. The Tomkins-Johnson Co. Jackson, Mich.

Raise
Lock
Brake
Press
Spin
Turn
Grind
Weld
Lower
Squeeze
Bend
Coin
Saw
Tap
Index
Braze
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Time
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Snub
Form
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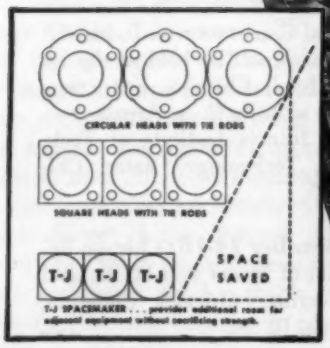
etc.

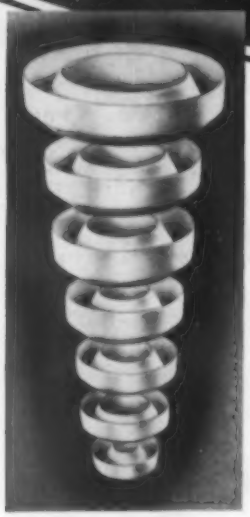

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
T-J
T-J
T-J
SPACE SAVED
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

Member of the National Fluid Power Association

"JOHN CRANE"

TEFLON* "C-V" rings



First preference in hydraulic service everywhere! because...

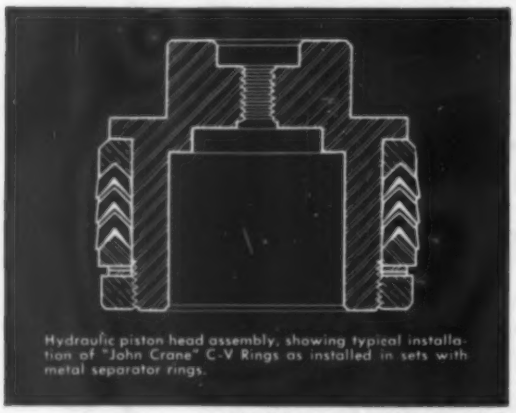
Teflon "C-V" Rings withstand

1. Temperature from —94° to +482°F.

2. Any type hydraulic fluid

Why repack with ordinary materials when corrosively inert "John Crane" Teflon "C-V" Rings will effectively seal any hydraulic fluid, including the newly developed synthetics, and resist high temperatures as well. Also, they have extremely low friction characteristics—will not shrink, swell, harden, dissolve, corrode or deteriorate. Ideal for use on hydraulic cylinders, valve stems, reciprocating, centrifugal and rotary pump applications. Cross-section design allows effective sealing at finger-tight gland pressure.

"John Crane" has developed a complete line of standard size Teflon "C-V" Rings and male and female adapter rings to meet practically every need. If you have special requirements, "John Crane" can mold additional sizes to fit your stuffing box requirements.



Hydraulic piston head assembly, showing typical installation of "John Crane" C-V Rings as installed in sets with metal separator rings.

Send for complete information, including this illustrated technical booklet, "The Best in Teflon." Crane Packing Co., 1805 Cuyler Ave., Chicago 13, Ill.

In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

* *Du Pont trademark*

JOHN CRANE CRANE PACKING COMPANY

BRIEFS continued

FUTURE EVENTS

July 25-29 and **August 1-5:** Two special programs on Strain Gage Techniques. First week "Fundamentals of Strain Gage Techniques", second week "Applications of Strain Gage Techniques". Massachusetts Institute of Technology, Cambridge, Mass.

September 6-17: The National Machine Tool Show at the International Amphitheatre and the Production Engineering Show at the Navy Pier, will be held simultaneously in Chicago. The Production Engineering Show will include exhibits of hydraulic and pneumatic components, electronic devices, lubricating systems and many others.

September 12-16: "Instrumentation Paces Automation" is the theme of the 10th Annual Instrument Conference and Exhibit of the Instrument Society of America, scheduled for the Shrine Exposition Hall and Auditorium, Los Angeles. In conjunction with this conference will also be an Analytical Instruments Clinic.

October 10-12: Second Annual Lubrication Conference sponsored by the American Society of Lubricating Engineers and the Lubrication Activity Group of the American Society of Mechanical Engineers, to be held at the Antlers Hotel, Indianapolis, Ind.

October 24-28: The Canadian Tool & Equipment Show, to be held at the Show Mart, Montreal, Canada.

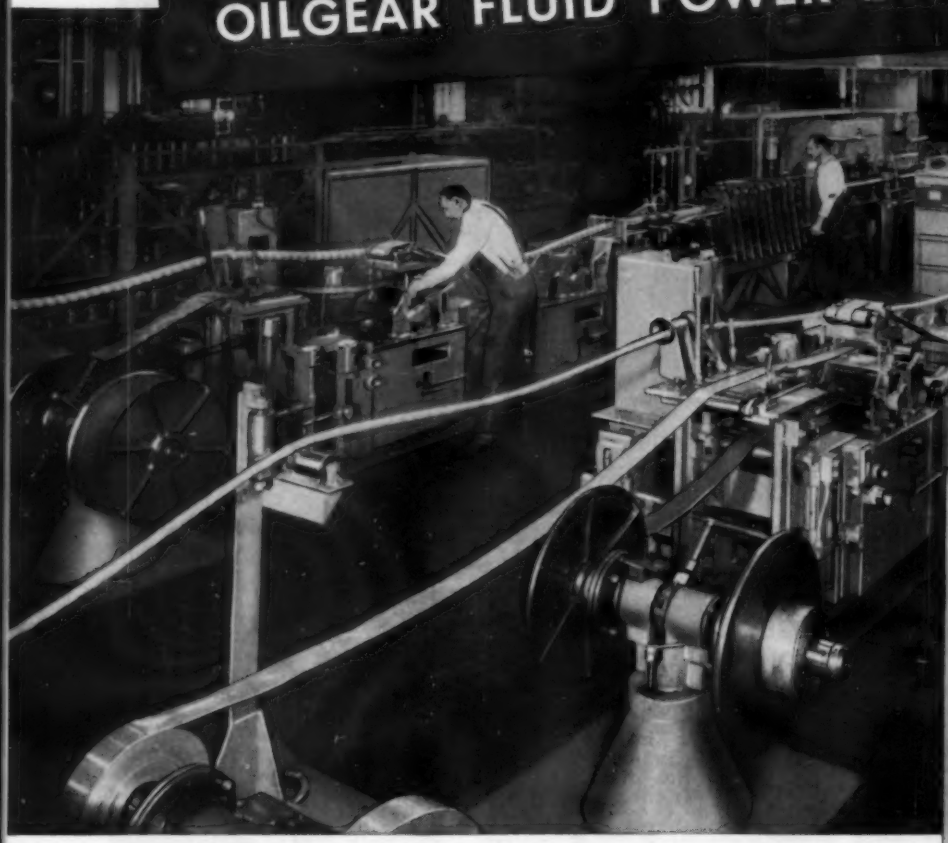
October 27-28: The Eleventh National Conference on Industrial Hydraulics will be held at the La Salle Hotel, Chicago. For reservations write to C. A. Arents, Secretary, Illinois Institute of Technology, Technology Center, Chicago 16.

November 14-18: Chicago Exposition of Power and Mechanical Engineering. Chicago Coliseum, Chicago, Ill. ▼▼▼

Circle 31 on Reader Service Card

Circle 95 on Reader Service Card

Here, Western Electric Employs OILGEAR FLUID POWER DRIVES



Solving the problem of close synchronization of driven members

As machines become more and more complex, combining more and more functions into a single unit, the problem of driving these machines successfully becomes more difficult.

This problem confronted Western Electric Company engineers in designing what they call their "Stalpeth" machines, two of which are shown above. These machines combine corrugating of steel and aluminum strips, forming them around the cable core, soldering the seam and then winding the assembly on reels at the far end. All of the members of the machine must be synchronized to the speed of the capstan unit. Going by their experience with other somewhat similar machines, Western Electric engineers again turned to Oilgear *"Any-Speed"* Fluid Power Drives, to solve what is really a complex problem ordinarily. Oilgear units provided an easy and economical means of synchronizing many machine components.

Oilgear *Any-Speed* Fluid Power Drives and transmissions *do* offer many machine design advantages including ease of control and synchronization of driven members, steplessly variable speed, fundamentally simple circuits, and long, trouble-free life. Write for Oilgear drive bulletins. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

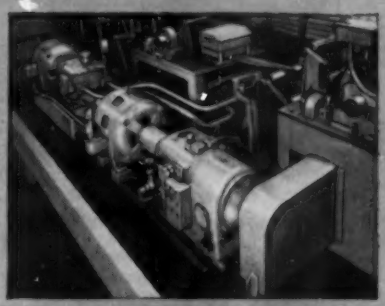
OILGEAR
Fluid Power

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

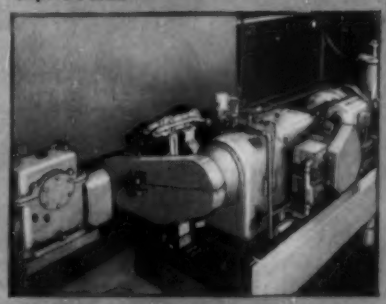
PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

"Stalpeth" machines add moisture barriers to telephone cable

These machines receive cable core, wrap it in aluminum and steel, solder the seam and coil it on reels. Oilgear *ANY-SPEED* Fluid Power Drives are an easy and economical means of synchronizing many machine units without a long lineshaft.

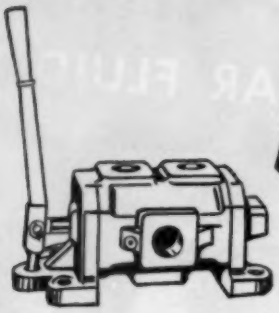


These Oilgear *ANY-SPEED* units drive the aluminum and steel corrugator units in perfect unison with the governing capstan unit.



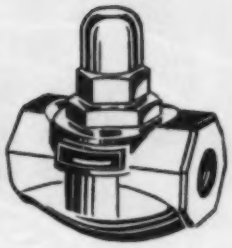
The Oilgear *ANY-SPEED* capstan drive. Not shown here is another Oilgear unit driving the cable winding reels.

Logan HYDRAULIC VALVES.....



Illustrated, Model 4095 —4-way, 2-position valve for directing pressure alternately to ends of double-acting hydraulic cylinder.

Illustrated, Model 8015 adjustable speed control valve. Install between operating valve and one end of cylinder to meter flow of oil in one direction with free flow on return.



A broad range of types and sizes to most effectively meet any requirement—Design Engineers, Machine Operators, Maintenance Men appreciate these Logan advantages

- LONG-LIFE CONSTRUCTION
- EASY TO SERVICE
- INFREQUENT MAINTENANCE
- EASE OF INSTALLATION
- EFFORTLESS OPERATION
- UNRESTRICTED PORTING

On your products and in your plant, the enlarged line of standard Logan Hydraulic Control Valves offers many profitable advantages in selection, installation, use and maintenance. Standard Logan Hydraulic Valves are designed for 1500 psi service. The broad range of types and sizes makes it easy to select the most effective valve for every problem.

Balanced-pressure construction of these piston-type valves places identical pressure on both ends of the piston, thus providing effortless operation.

All ports and internal chambers are full pipe size with valve piston light in weight, thus assuring rapid response and fast reversal without excessive vibration or wear.

Highly compact design permits easy installation in restricted areas. Master control valves have four mounting feet located on end covers for easy mounting.

The valve body, which includes the ports, can be rotated 360° on the end covers to four positions at 90° intervals, when socket-head cap screws are removed from the covers. Permits convenient and efficient location of pipe connections. Alternate inlet ports, with one port plugged, provide added flexibility.

The ease with which pipe connections can be made often eliminates the necessity for costly special valves. Elimination of elbows, street ells, bends, etc. minimizes internal friction, thereby increasing efficiency and reducing costs.

The tough, wear-resistant alloy steel piston, hardened and ground, provides a close, sliding fit in the valve body. Both body and end covers are chrome nickel iron castings which furnish a good bearing surface to assure superior wearing qualities.

Both wear and maintenance are reduced in the Logan sliding-piston construction through elimination of valve seats and packing. The two stem seals at ends of piston are subject only to exhaust pressures.

With the removal of end covers, the standard seals are easily replaced and the piston may be removed from the vaive body for examination without disconnecting the piping.

Logan Hydraulic Control Valves offer many other advantages which assure longer, more effective performance and low maintenance.

For full information write for Logan Catalog 200-4.

Let Logan Engineers help you design your Air and Hydraulic Circuits. You will not be obligated.

Wherever there's a holding or motion requirement, there's a Logan design to do the job.

Member—National Tool Builders Assn.; National Fluid Power Assn.

LOGAN MANUFACTURES 7,023 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME — Logan — AIR AND HYDRAULIC EQUIPMENT — EFFORT • MOTION

LOGANSPORT MACHINE CO., INC., 832 CENTER AVE., LOGANSPORT, IND.

HYDRAULIC DANGER ZONE

Ordinary hydraulic fluid, escaping under pressure, can start a fire 40 ft. or more away from a broken line! Is your plant safe? Here's how one firm protects men and machines inside the danger zone...

PYDRAUL INCREASES SAFETY, EFFICIENCY OF NEW 1900° FURNACE

MIDWEST PIPING COMPANY, INC., ST. LOUIS, designed two pipe-bending furnaces with hydraulic doors to replace dangerous levers. But the system created a problem: If 800 psi hydraulic lines were ruptured by falling brick or pipe, escaping fluid would explode immediately in 1900° F. furnace! Midwest investigated, then solved the problem by installing fire-resistant Pydraul fluid in all hydraulic lines. Result: Operators are safer . . . danger of hydraulic fires is eliminated . . . excellent lubricity of Pydraul has increased operating efficiency.

Pydraul: Reg. U. S. Pat. Off.

FIRE RESISTANT

In tests and actual service, Pydraul has been discharged over molten metal, red-hot ingots, arcs, open flame and sparks without fluid igniting . . . even at temperatures up to 6000° F!

. . . AND A TOP-GRADE LUBRICANT

After 200-hr. Vickers Vane Pump Test, pump rotor operated on petroleum fluid showed weight loss of 2.9 grams due to wear. Rotor with Pydraul lost no weight—lost only 0.1 gram after 800 hrs! Timken Lubricant Test and Almen Wear Test also show Pydraul excellent in lubrication characteristics.

PLUS . . .

HIGH STABILITY
LOW MAKE-UP RATE
CONTAINS NO WATER
NON-CORROSIVE
RE-USABLE

FREE BOOKLET

Write now for new free booklet, "PYDRAUL F-9." Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478 I-4, St. Louis 1, Missouri.

MONSANTO
CHEMICALS—PLASTICS
Serving Industry . . . Which Serves Mankind

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

LUBRICATION CHART . . . E. F. Houghton & Co. announces a wall chart containing lubrication recommendations for many applications. The chart gives information for lubrication of hydraulic systems, spindles, air compressors, reduction gears, electric motors, etc. The 2-color chart is printed on tough varnished stock for display in the shop, and helps eliminate lubricant mistakes.

Circle 140 on Reader Service Card

AIR, HYDRAULIC VISES . . . for milling, tapping, assembling, and other operations are featured in information sheets from Elect-Air Tool Co. The vises are powered by air or hydraulic cylinders, and are designed so that the cylinder and mechanism of most models are enclosed within the vise body. Most of the vises are equipped with the chip plate and felt installation which practically eliminates movable jaw clogging by fine milling chips. These vises can be operated manually or synchronized with the movement of the machine tool.

Circle 141 on Reader Service Card

AIR-MOISTURE SEPARATORS . . . for removing entrained water from the cold air supply of aircraft-cabin air conditioning systems are presented in a brochure from Stratos. General operation, installation, performance, and service information is given. Because the air leaving an aircraft refrigeration unit becomes supersaturated under certain conditions, it is necessary to remove the moisture to prevent fogging on instruments and canopies. The air-moisture separator removes over 80% of this moisture and eliminates undesirable condensation.

Circle 142 on Reader Service Card

SOLENOID VALVES . . . Skinner Electric Valve Div. has released their 50-page Catalog No. D1 covering their line of solenoid valves. The catalog describes the company's high pressure hydraulic valves among other types for air, water, and oil at lower pressures. A convenient chart is included as a guide in the selection of a valve for a particular medium. Also included are cut-away views of the different valves and progressive diagrams showing the operation. Flow rate charts plot fluid flow against pressure drop for each valve type. Detailed selection and application information is given in well organized, simplified form. A valuable appendix includes a glossary of terms, useful conversion ratios, specific gravities of gases and liquids, and calculation methods for determining flow rates, pressure drops, orifice sizes, and electrical current requirements.

Circle 143 on Reader Service Card

ROD END BEARINGS . . . are specified in Catalog No. 2155 issued by Southwest Products Co. The catalog contains tables of dimensions and load ratings of the company's commercial rod end bearings. The new line of bearings is available in bore sizes from 3/16 to ¾ in. and can be furnished with a lubrication fitting.

Circle 144 on Reader Service Card

DAMPING DEVICES . . . "Damping Devices—Past, Present, Future" is the title of a comprehensive book published by The Gabriel Co. The book reviews the history of damping devices and includes a complete description of the development and use of closed circuit diagrams and load-velocity charts for the measurement of damping device performance. Six standard damping devices are shown and described in detailed drawings and charts.

Circle 145 on Reader Service Card

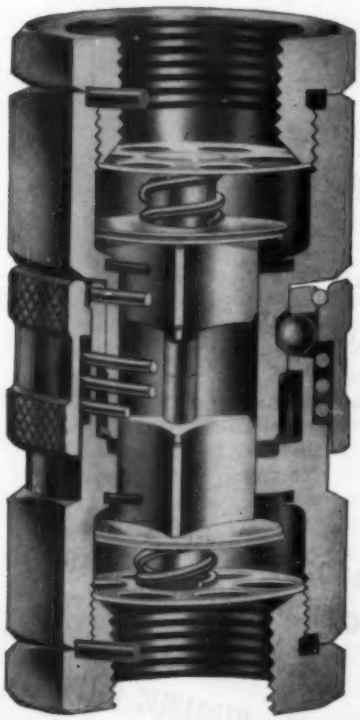
DIAPHRAGM . . . A 16-page catalog, BF 150 has been prepared by Bellofram Corp. to describe their various classes of long stroke, deep convolution diaphragms. Included are tables of standard sizes, available materials, dimensional data tables, and design data. Illustrated with photographs and application drawings, the catalog will be kept current by subsequent mailings of technical bulletins.

Circle 146 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 126

DISCONNECTED IN 1 SECOND

and NO DANGEROUS SPRAY



INSTALL SNAP-TITE "H" COUPLINGS:

- Snap-Tite "H" Series couplings are constructed so that the valve is completely closed in coupler before disengaging the nipple seal, eliminating fluid spray, and the only loss of fluid is the few drops in the nipple cavity.
- Powerful springs keep valves shut tight when "H" couplings are disconnected.

Check your couplings. Are they creating accident hazards and losing costly fluids? Are offensive odors and flammable gases escaping from them?

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—these combine to allow maximum flow capacity with lowest pressure drop.

Available in sizes ⅛" to 10" in alloy steel or to specifications

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

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UNION CITY 1, PENNSYLVANIA

Compactness
IS THE RULE ON ALL

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**SERIES R H 2000 P.S.I. and SERIES H
1000 P.S.I. HYDRAULIC CYLINDERS**

On all of your hydraulic cylinder applications the appropriate Pathon cylinder will give you the minimum in mounting size with increase strength and fatigue life.

A PATHON HYDRAULIC CYLINDER HAS...

LOW STRESS CONCENTRATION through the head to barrel attaching area providing a plus factor for shock loads. The single screw thread attaching method gives maximum strength in minimum space.

Our new thirty-two page bulletin covering these cylinders is now being distributed. Write for your copy.

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MANUFACTURING CO.

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AIR CYLINDERS...HYDRAULIC DIRECTIONAL CONTROL VALVES...HYDRAULIC CYLINDERS

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'VSG'

Regd. Trade Mark

Infinitely VARIABLE SPEED HYDRAULIC TRANSMISSION GEARS

Aluminium Sheathing Plant

Aluminium Sheathed Cable, pioneered and developed by Johnson & Phillips Ltd. in their Plant in Britain, requires, for its cheapness, lightness and easy installation, a special manufacturing technique. Owing to the difficulty of extrusion, oversize aluminium tube is drawn down on to the cable through a die by a large diameter Hauling Gear. For this process, as for many others in modern industry, accurate speed control and high torque at low speeds are essential. 'VSG' Drives have been selected to meet these requirements.

Are you aware of the full possibilities of 'VSG' Hydraulic Power Transmission? Write to us today and we will mail you further details.

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VICKERS HOUSE · BROADWAY · LONDON · SW1 · ENGLAND *Cables* **VICASTRONG LONDON**

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D15c

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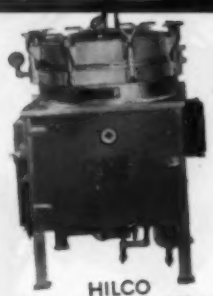
HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.



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OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

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THE HILLIARD *Corporation*

148 W. FOURTH ST. • ELMIRA, NEW YORK

IN CANADA:

LETTERS

to the editor

Pneumatic Surge Chambers

I receive APPLIED HYDRAULICS through the courtesy of Nielsen Hydraulic Equipment Inc., for which I am very grateful. If my memory serves me correctly, approximately one year ago your magazine carried an article regarding the design of pneumatic surge chambers to reduce pneumatic pulses in compressed air systems. May I have a copy of this article?

W. S. KLECZEK
General Electric
Rocket and Ramjet Section

We have sent you tearsheets of the article "Pneumatic Counterbalancing of Mechanical Presses" which may be the one you have in mind. The article includes information on the selection of a surge tank.

Wants a Flow Divider

Some time ago, I saw material in APPLIED HYDRAULICS for a sort of metering valve to meter the same amount of oil to two different cylinders, in order that the rise and fall is the same. This unit consists of a housing, in which two gears fastened solidly to a shaft rotated. The oil entered between the two gears and was channelled to them. Can you tell us who makes such a unit?

W. M. KEIL, P. E.
The Youngstown Foundry & Machine Co.

What you describe is a flow dividing valve or flow equalizer. Names of several manufacturers of this product have been sent to you.

Magnified Oil Level Gage

Please send us the names of manufacturers for oil level gages of a type that allows magnification of the oil level. Magnification is required because the surface to be measured is at a considerable

Continued on page 44

SAVE BY SWITCHING TO SUN HYDRAULIC OILS

If your system is in this condition	This is the Sun Oil recommended	And this is why
TIGHT SYSTEM. System never changed. Little or no make-up oil added.	**SUNVIS 900**	Exceptionally long life of Sunvis 900 keeps overall costs low.
TIGHT SYSTEM. Changed annually. Make-up oil added when needed.	**SOLNUS**	Solnus is a quality oil with a long life and a moderate price.
LEAKY SYSTEM without dilution. Where make-up averages 5% or more per month.	**SUNTAC**	Suntac cuts oil costs by reducing leakage an average of 35%.
LEAKY SYSTEM with dilution from water, cutting oil, emulsions and other liquids. Frequent change needed.	**CIRCO**	When frequently changed, Circo gives excellent protection at a low price.
DEPOSITS BUILT UP inside system from dust, sludge, varnish or other contaminants. Comparatively tight system.	**SUNVIS H.D. 700**	The cleansing action of Sunvis H.D. 700 removes deposits, eliminates costly tear-downs for cleaning.
DUAL PURPOSE. Machine tools designed so that hydraulic oil also lubricates ways.	**LUBEWAY**	A good hydraulic oil, Lubeway has the film strength needed to protect expensive ways.

No one oil can give greatest economy in *all* hydraulic systems. As this chart points out, the condition of the system must be considered. To make sure that the oil you select will give the maximum economy in your particular system, have a talk with your Sun Oil Company representative. Or write Department AH-7.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous High-Test Blue Sunoco Gasoline

EAGLE MULTIPULSE repeat cycle timer

2″ diameter cams adjustable within ½%

This compact Timer features in its construction an "Expandex" hub— an Eagle Signal exclusive. Hub can be loosened or tightened until there's just enough friction between it and the cam shaft to allow moving the cam a hair thickness distance . . . as little as ½% of one revolution. Close settings are further facilitated since the "Expandex" hub eliminates shaft indentations caused by set screws. There is no occasion for a set screw to slip into a previous indentation.

Opening or closing as many as 12 circuits in sequence, the Eagle Multipulse Repeat Cycle Timer is ideal for sequence starting of several motors, timed sequencing of automatic cement block machines, and sequence operation of solenoid valves in washing processes.

Cycle change gears provide 3 to 1 time range. Available with 2 to 12 circuits . . . and with time cycles from 18 seconds to 36. hours. Synchronous motor powered. S.P.D.T. enclosed contacts. Available with cams factory set if desired. Send for free Bulletin 323.

MAIL COUPON TODAY

EAGLE SIGNAL CORPORATION
Industrial Division, Dept. AH-755
MOLINE, ILLINOIS

Please send free Bulletin 323 containing full data on Multipulse Repeat Cycle Timer.

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

EAGLE SIGNAL CORPORATION
Industrial Division
MOLINE, ILLINOIS

LETTERS to the editor

height above the observer, and it is necessary to maintain the oil level within plus or minus ½ inch.

A. F. GLEDHILL
Pacific Oerlikon Company
Tacoma, Washington

A list of manufacturers of oil level gages has been sent to you. Several of these concerns may be able to supply a magnifying type gage.

Starting on page 94, you'll find a report about the recent Fabricating Machinery Hydraulics Conference. About 100 builders and users of welders, die cast and plastic molding machines and presses, discussed their experiences and techniques in applying oil hydraulic equipment. If you want to add to the discussion of any of the questions, put your comments in a letter to us.

One Repairman's Ideas

I am responsible for all installation and maintenance of hydraulic equipment in our plant. My best guide for tracing any circuit trouble is the hydraulic schematic. While J.I.C. symbols help to trace a circuit, I don't get adequate drawings from most machine builders. Here are two suggestions that I would like to see adopted.

First, if the hydraulic system has, for example, 4 phases of operation, 4 drawings of the circuit should be supplied. On each drawing those components in use for one phase of operation should be drawn in color. Having these drawings, if trouble develops in any one phase, the drawing for that phase is used to check the machine. This quickly eliminates from consideration those components which are not involved in the particular phase.

Second, I would like to have numbers marked on all valves on the machine to correspond with numbers of the valves on the draw-

Continued on page 46

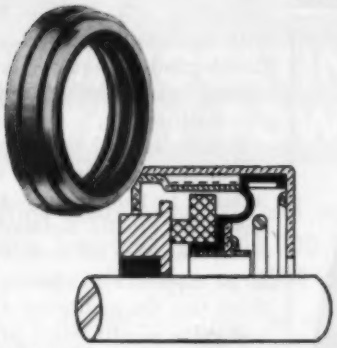
Circle 37 on Reader Service Card

Circle 52 on Reader Service Card

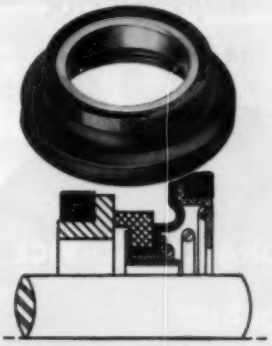
BIGGEST SELECTION AVAILABLE ANYWHERE!

Modern, Mechanical, Face-Type Seals —
Standardized, To Save Time And Money

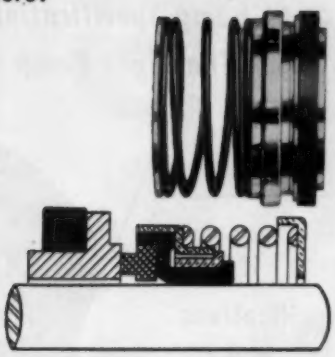
Is YOUR Sealing Problem Solved Here?



STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Important applications in **machine tools** and **power transmission equipment.**

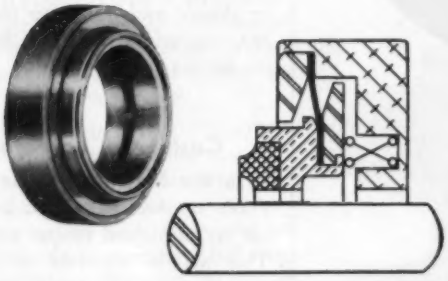


STYLE SGU — A factory-assembled unit-type seal for the small budget-user. Widely used in **appliance** field.

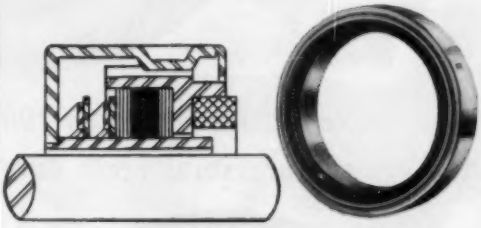


ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Many applications in **pumps** and **compressors.**

STYLE RFO—a specially designed Roto-flex seal, for installation outside the stuffing box.



STYLE DPC—A high-speed, carbon-faced seal, for use where lubrication is poor or where shaft RPM and resulting friction are high. Ideal in many **machine tool** applications.



STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Of particular importance to the **aircraft** industry.

These are only a few of the countless sealing problems now being solved by

GITS SHAFT SEALS

Submit Your Next Sealing Problem To

GITS BROS. MFG. CO.

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Specialists In Lubricating Devices And Shaft Seals For Almost Half A Century

TUTHILL SIMPLIFIES PUMP SELECTION

New Cataloging Plan Provides Practical Short-Cuts to Pump Specifications — Helps You Pick The Right Pump for the Purpose

If Your Specifications Call for Pumps for...

- HYDRAULIC SERVICE
- COOLANT
- TRANSFER
- CIRCULATING

In capacities from 5 to 200 g.p.m. and pressures up to 400 p.s.i.

...Write for Tuthill Catalog 103

Catalog 103 covers the Model CK ball bearing series of rotary, internal-gear positive displacement pumps.

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Illinois

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LETTERS to the editor

ings. On machines using many of the same model valve, matching a particular valve on the machine with its counterpart on the circuit drawing often requires time consuming tracing of the piping on the machine.

I have applied these two ideas in our shop and find that the time it takes to troubleshoot a circuit has been greatly reduced. Since these ideas are of most value on large expensive machines, I don't think that the additional drawings and valve identification procedure would make much difference to the overall cost.

JOHN WRIGHT
S & J Molded Products

What do you think about Mr. Wright's procedure? Should the machine builder adopt these ideas or should each user alter the drawings and add numbers to the valves on his machines?

Cushioned Actuators

In the May 1955 issue of APPLIED HYDRAULICS we find an article on cushioned torque actuators. This article interests us because we have on a number of occasions used such actuators and those we have used do not resemble the illustration. We would very much appreciate it if you could supply us with the name of the manufacturer.

E. H. L. JOHANNES
Director Equipment Div.
Campbell Soup Company
Camden, N. J.

The torque actuator was built by Wilson Automation Company in Detroit for the machine shown in the article. Since they are machine builders, we do not believe that they market this actuator. There are at least two manufacturers of the vane type actuator who might consider supplying you with units having built-in cushions. Built-in cushions are not, to our knowledge, standard on this equipment. Names of the manufacturers have been sent to you.

▼▼▼

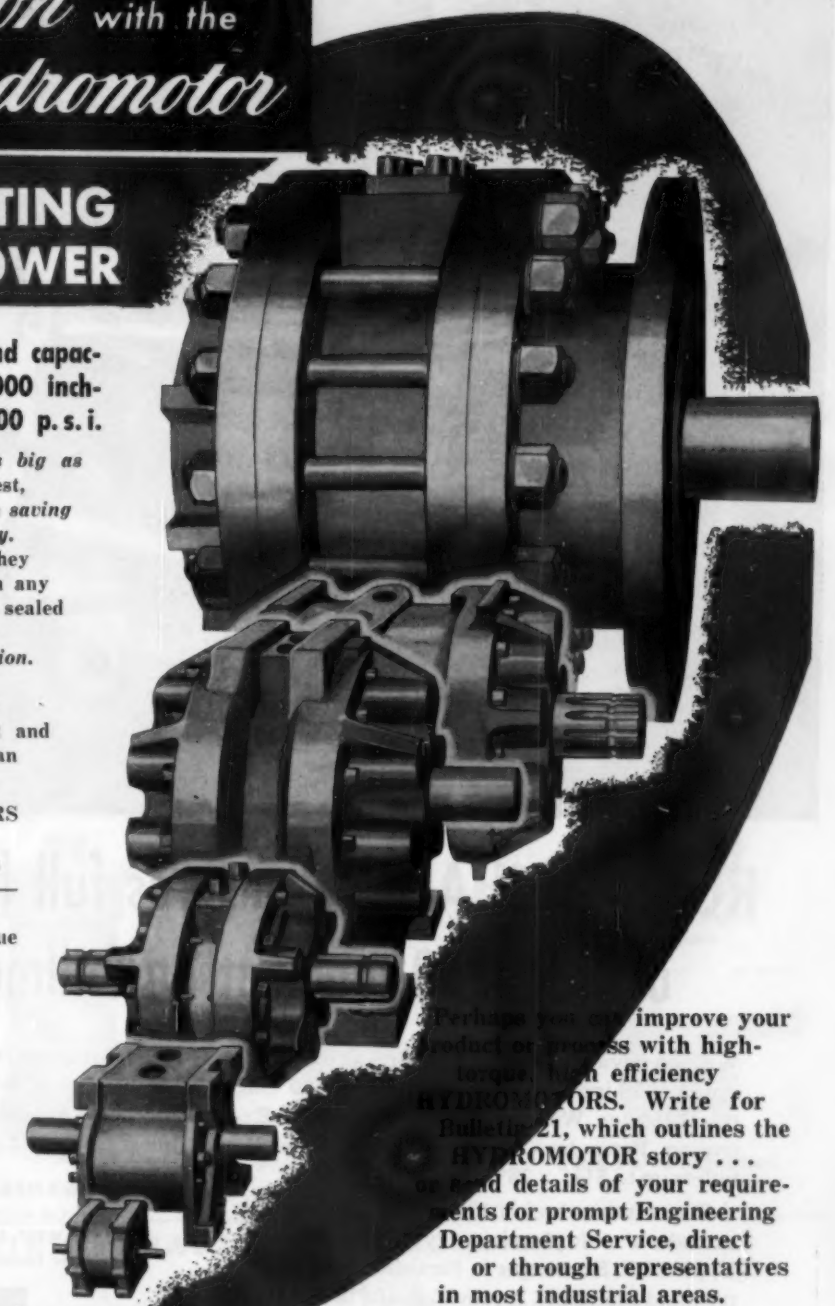
Automation with the Bonnot *Hydromotor*

RECIPROCATING ROTARY POWER

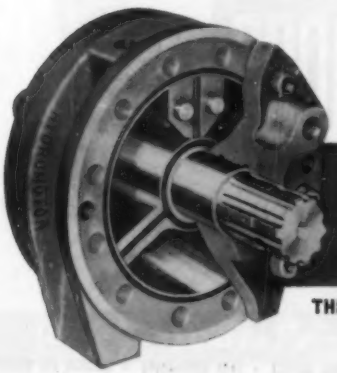
Wide choice of models and capacities from 150 to 1,000,000 inch-pounds of torque at 1000 p. s. i.

From the smallest *(only as big as your fist)* through the largest, *Bonnot* HYDROMOTORS are *saving users time, space and money.* Compact and lightweight, they can be mounted anywhere, in any position and are completely sealed and self-contained to insure *dirt-free, trouble-free operation.* HYDROMOTORS eliminate expensive, bulky mechanical linkages, installation is fast and easy, maintenance is cut to an absolute minimum.

With Bonnot HYDROMOTORS *reliable automation* can be achieved more simply. This reciprocating rotary actuator—operating with air, water or oil—develops instant full torque in either direction. Standard units travel 280° and develop 150 to 500,000 inch-pounds of torque. Double vane units—with maximum travel of 100°—approximately double the above torque values of the single vane unit IN THE SAME SIZE HOUSING. Special sizes are custom-built to individual specifications.



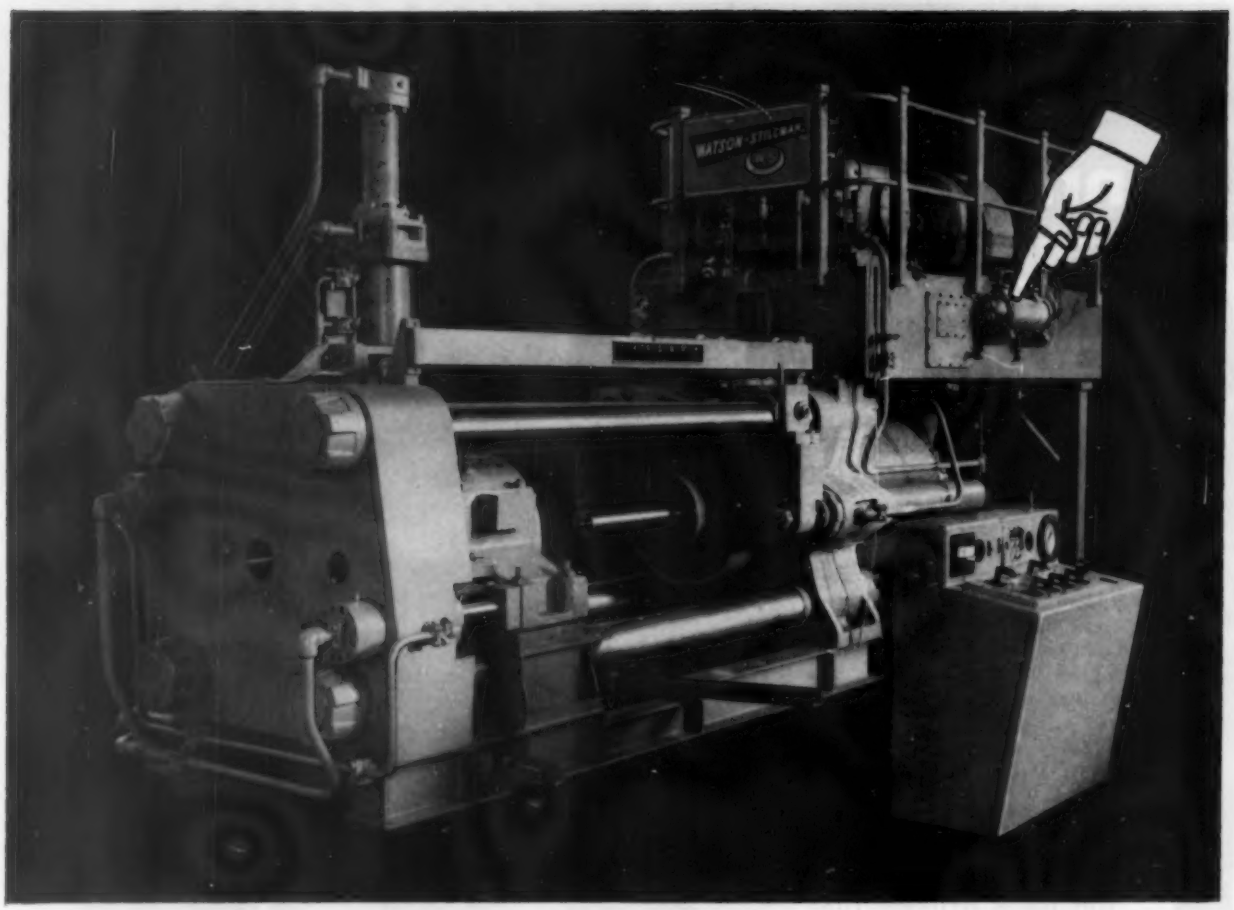
Perhaps you can improve your product or process with high-torque, high efficiency HYDROMOTORS. Write for Bulletin 21, which outlines the HYDROMOTOR story . . . or send details of your requirements for prompt Engineering Department Service, direct or through representatives in most industrial areas.



Hydromotor DIVISION

THE BONNOT COMPANY • CANTON 2, OHIO

LOWERING • REVOLVING
LIFTING • PUSHING • PULLING
SWINGING • OPENING
CLOSING • CLAMPING • TURNING
INDEXING • OSCILLATING, ETC.



ROSS EXCHANGER insures full hydraulic power of this 1250-ton Watson-Stillman Extruder

With an advance speed of 440 ipm, an extrusion speed of 29 ipm and a return speed of 670 ipm, this 1250-ton Watson-Stillman Aluminum Extrusion Press has been equipped to handle billets up to 5⅛" x 24".

To maintain the full 108 gpm capacity of this extruder's multiple piston type pump, a Ross Type BCF Exchanger is furnished here. Compact and accessible, it provides safe, dependable oil cooling at all times.

Assuring the utmost in thermal efficiency and ruggedness, Ross Exchangers are regularly installed on numerous types and makes of metal working equipment: metal drawing presses, die casting machines, welders, as well as engines, compressors, lubrication systems and speed increasers . . . to cool hydraulic fluid, jacket water and lube oil.

Pre-engineered, fully standardized and stocked in a wide range of sizes, they are promptly available to answer *your* needs. Request Bulletin 1.1K5.

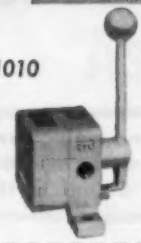
KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1431 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

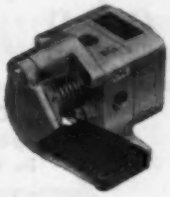
Ledeen

PNEUMATIC AND HYDRAULIC EQUIPMENT

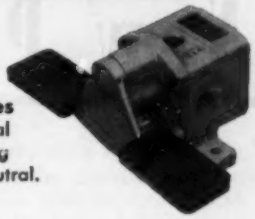
VALVES
bulletin 1010



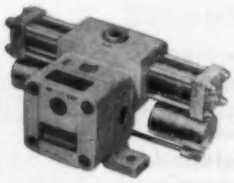
Hand Valves Manual or spring return to neutral or to reverse.



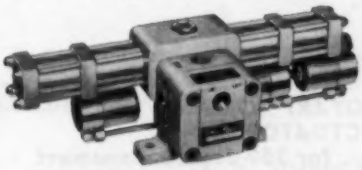
Foot Valves Single pedal spring return to reverse.



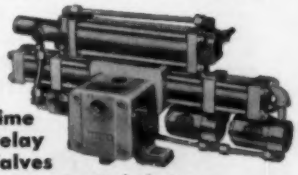
Foot Valves Double pedal foot or spring return to neutral.



Power Valves Two position, forward and reverse.

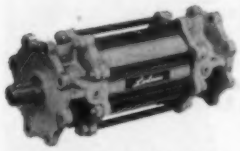


Power Valves Three position, forward, neutral and reverse.

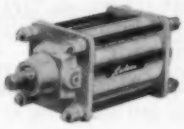


Time Delay Valves Power operated closing after delay interval.

CYLINDERS
bulletin 500



Heavy Duty Cylinders



Medium Duty Cylinders

Boosters

Special Cylinders

VALVE ACTUATORS
bulletin 3030

Gate Valve Actuators

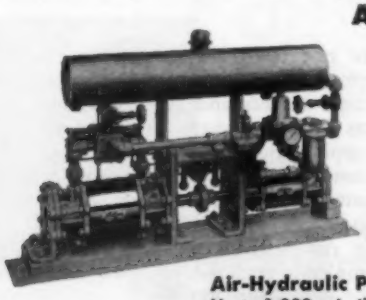
Diaphragm Valve Actuators

bulletin 3020

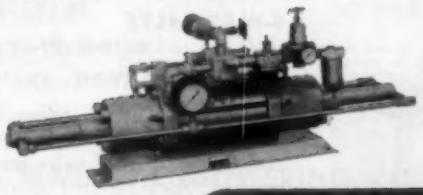
Plug Valve Actuators

Plug Valve Actuators

AIR HYDRAULIC PUMPS *bulletin 4000*



Air-Hydraulic Pumps Up to 1,000 psi oil from 100 psi air or gas.



Air-Hydraulic Pumps Up to 10,000 psi oil from 100 psi air or gas.

Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Top quality—prompt delivery

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

ROTARY TORQUE ACTUATOR
. . . for 300-degree movement

Designation: AE Roto Jack

Design: Actuator consists of a cylindrical housing with end caps containing a shaft with attached vane. Hydraulic oil up to 1000 psi or lubricated air under pressure rotates shaft 300 degrees against an internal stop. Speed of the shaft is determined by the capacity of the pump. Torque depends on pressure on the vane, and torques up to 10,000 are obtainable.

Installation: Unit can be face mounted, or bracket can be added for flange or foot mounting. Installation requires only connections of fluid lines, and unit is controlled with simple valving. Double shaft extensions are available.

American Engineering Co.
Philadelphia, Pa.
Circle 190 on Reader Service Card

HYDRAULIC GEAR PUMPS
. . . for mobile equipment

Designation: Model Series 051002, 052973, 052941

Features: Pumps have "pressure loading" of bearings for volumetric efficiencies up to 97%. Fluid pressure from the outlet side is exerted on the pump bearings to maintain the end clearance between gear and bearing faces at a thin film of oil. Wear is reduced and the pump lasts longer. Automatic compensation for any wear that does occur maintains efficiency of the pumps.

Applications: Pumps are applicable to lift trucks, tractor front-end loaders, road graders, and other mobile equipment.

Specifications: Pumps may be equipped for base, round flange, or magneto flange mounting. Each unit has keyed shaft, side ports, and assembly for rotation in either direction. Pumps are available for flows from 10 to 16 gpm and pressures of 1500 and 2000 psi. Rated speeds are 2000 and 2200 rpm.

Pesco Products Div.
Borg-Warner Corp.
Bedford, Ohio
Circle 191 on Reader Service Card

4-WAY VALVE
. . . with built-in relief

Designation: Holdkontrol

Features: Valve is manually operated. Valve remains in operated position until relief valve setting is reached. Spring-loaded spool then returns to neutral position where the load is maintained. This frees operator from holding valve in an operated position. Loads requiring from 500 psi to 2000 psi can be sensitively handled with any oil flow rate from 2 gpm to over 12 gpm. Special features of the valve protect loaders and other mechanisms against damage due to load dropping. Built to withstand surge pressures to 5000 psi. Three-point mounting and 360-degree swivel handle permit flexibility of mounting. All parts and mechanisms are completely enclosed.

Char-Lynn Co.
Minneapolis, Minnesota
Circle 192 on Reader Service Card

Continued on page 52

MORE AND MORE MANUFACTURERS ARE INSTALLING
MARVEL SYNCLINAL FILTERS
AS STANDARD EQUIPMENT

Manufacturers of hydraulically actuated equipment and others with low pressure liquid circulating systems demand their equipment to perform consistently and with all the productive efficiency they build into the machine that bears their name. Since these systems must be kept free of damaging particles, the selection of a filter is an important factor. Here are some of the outstanding reasons for the increasing preference for Marvel Synclinal Filters to do this all-important job!

SUMP TYPE
(Cutaway)

BECAUSE . . . Marvels are designed to give maximum ACTIVE filtering area rather than total filtering area. Only *ACTIVE* FILTERING AREA COUNTS!

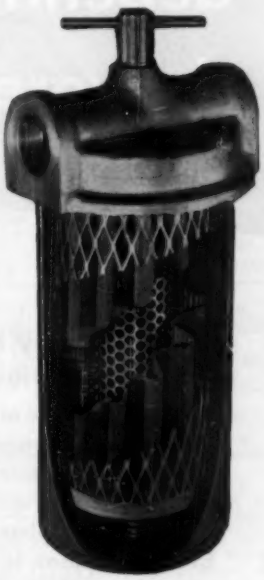
BECAUSE . . . Marvels greater storage space for filtered out particles allows longer periods of "production" time at absolute minimum in maintenance cost and "down-time".

BECAUSE . . . Marvels can be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates efficiently in any position and may be serviced without disturbing pipe connections.

BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration.

BECAUSE . . . Marvels (Both Sump and Line Type) are available in capacities from 5 to 100 G.P.M. and choice of mesh sizes ranging from coarse 30 to fine 200, they get a filter to fit their specific requirements.

BECAUSE . . . Marvel not only delivers a top grade filter in both quality and performance, but, as in the past Marvel continues to offer IMMEDIATE DELIVERY.



LINE TYPE
(Cutaway)

FACTS — NOT CLAIMS

Engineers decide on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety. Here is a fact with meaning:

OVER 550 MANUFACTURERS MAKE MARVEL SYNCLINAL FILTERS THEIR O.E.M. CHOICE

For Dependable Protection On All Hydraulic And Low Pressure Systems Investigate MARVEL SYNCLINAL FILTERS

Catalogs containing complete data available on request

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd., Chicago 6, Ill., Phones: FRanklin 2-3530 & FRanklin 2-4431

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: AH-7
☐ Catalog #106—For Hydraulic Oils, Coolants and Lubricants
☐ Catalog #300—For WATER
☐ Data on filters for fire-resistant hydraulic fluids.

Name ..... Address .....
Title ..... City .....
Company ..... State .....

National offers you

Top quality O-Rings, dependably uniform, delivered on time!

Here's the way National insures uniform high quality in National O-Rings:

All ingredients are of highest quality, carefully inspected before compounding. Compounding is done under strict controls to insure absolute uniformity of batches. Molding is done on modern equipment by skilled veterans in O-Ring manufacture. Rings are given a complete precision trim, then complete inspection. Every precaution is taken to insure that no O-Rings with cuts, scratches or mold defects are shipped.

A complete line of industrial O-Rings, including the new small cross-section rings, is available for prompt shipment from convenient warehouses. Prices are most competitive. Call the nearest National Applications Engineer and prove this to yourself!

NATIONAL
OIL & GREASE SEALS
O-RINGS SHIMS

NATIONAL MOTOR BEARING CO., INC.

GENERAL OFFICES: REDWOOD CITY, CALIFORNIA
PLANTS: REDWOOD CITY AND DOWNEY, CALIFORNIA; VAN WERT, OHIO

CHICAGO, ILL. . . . *Room 4113 Field Building, FRanklin 2-2847*
CLEVELAND, OHIO . *210 Heights Rockefeller Bldg., YEllowstone 2-2720*
DALLAS, TEXAS . . . *30½ Highland Park Village, JUstin 8-8453*
DETROIT, MICH. . . . . *726 Lothrop Avenue, TRinity 1-6363*
DOWNEY (Los Angeles Co.), CALIF. . *11634 Patten Rd., TOpaz 2-8166*
INDIANAPOLIS, INDIANA . *2802 North Delaware St., WAlnut 3-1535*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. . . *Suite 814, 1180 Raymond Blvd., MItchell 2-7586*
REDWOOD CITY, CALIF. . . *Broadway and National, EMerson 6-3861*
WICHITA, KANSAS . . . . *519 South Broadway, WIchita 2-6971*

New Products / continued

SEALED SWITCH
. . . resets when ice-coated

Features: High operating and reset forces permit use of this switch in extreme conditions of aircraft applications. Hermetically sealed switch can be supplied with roller, leaf, cam, or other actuator. Wiring conduit opposite the actuating

mechanism permits greater flexibility, and the reduced weight and size permit installation in compact areas.

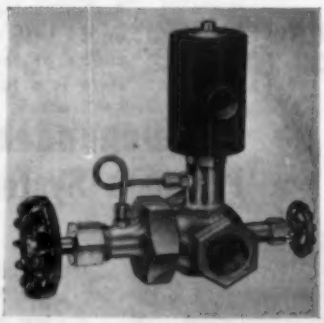
Specifications: Switch complies with Government specifications and is rated at 10 amperes, 125/250 volts ac, 28 volts dc.

Electro-Snap Switch Co.
Chicago, Illinois

Circle 193 on Reader Service Card

COMBINATION VALVE
. . . solenoid, throttle, check

Features: Check valve operates independently of the solenoid. Small wheel is for timing the closing of the valve. In bronze, valve is designed for pressure of 300 psi with



renewable disc, or 600 psi with renewable disc and nickle seat. Valve can be furnished in stainless steel for extremely high temperatures and pressures in sizes up to 10 in. Explosion-proof solenoids are available, and valve is supplied in sizes from ¾ to 3 in.

Hoppe Engineering Co., Inc.
Greensboro, Indiana

Circle 194 on Reader Service Card

Continued on page 55

Circle 94 on Reader Service Card

Circle 89 on Reader Service Card

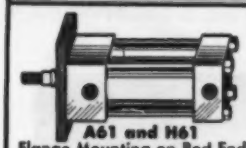
over 8,000 Different Cylinder SELECTIONS—

Miller AIR AND HYDRAULIC CYLINDERS AND BOOSTERS "IN STOCK" for immediate delivery...

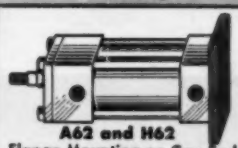
See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

"IN-STOCK" MODELS

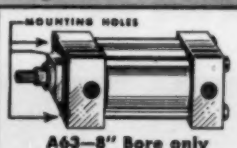
"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Rod On Drawings.



A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)

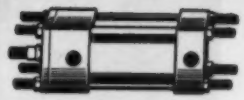


A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)

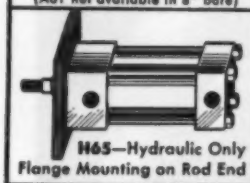


A63—8" Bore only
Flange Mounting on Rod End

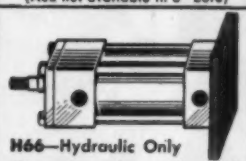
A64—8" Bore only
Flange Mounting on Cap End



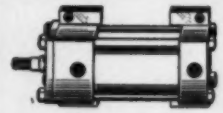
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



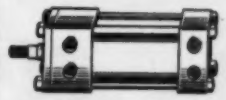
H65—Hydraulic Only
Flange Mounting on Rod End



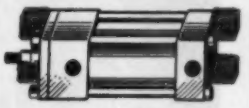
H66—Hydraulic Only
Flange Mounting on Cap End



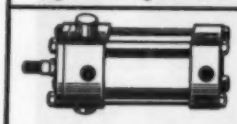
A72 and H72
Side Lug Mounting



A74 and H74
Side Flush Mounting

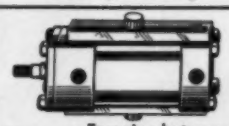


A77 and H77
Side or Foot Mounting

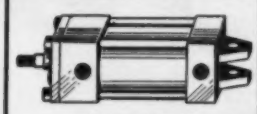


A81 and H81 Trunnion Mounting on Rod End

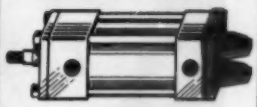
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap
(one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES

"IN-STOCK" STROKES (in Inches)

	Bores	Rod Dia.	Rod Turn Down & Threads		1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

(1) (4) (3) (2) (1) (4) (3) (2)

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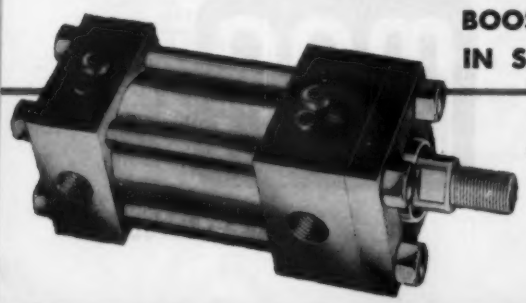
Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



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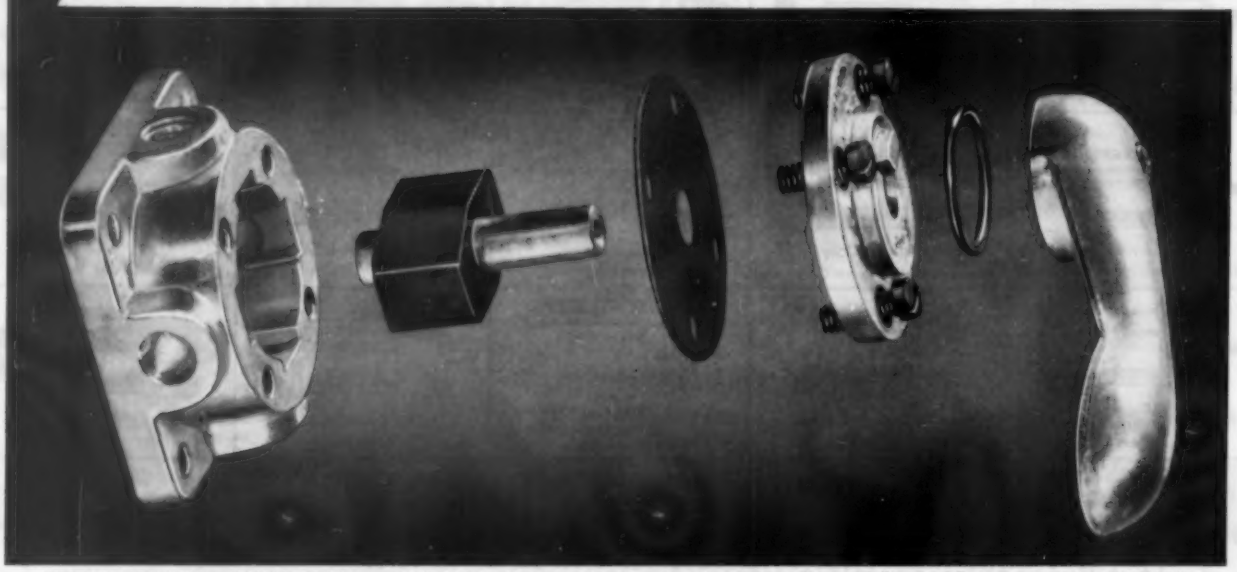

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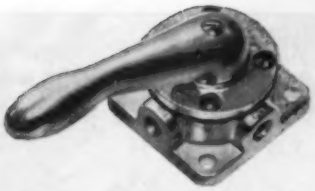

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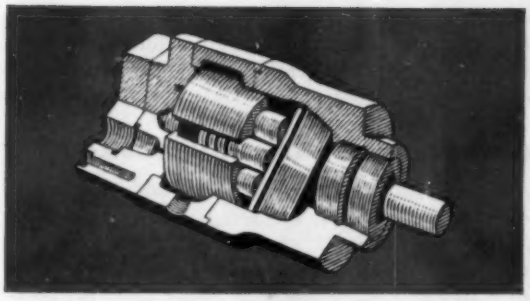

HIGH SPEED PUMP & MOTOR DESIGN...

depends on lubrication and material compatibility

• By R. H. Marvin

FUNDAMENTAL knowledge of lubrication and material compatibility can take much of the guesswork out of pump and motor development. Much of the work being done today to improve performance of hydraulic pumps and motors is aimed toward increasing operating speeds.

Figure 1 shows a typical fluid power transmission having a variable delivery pump supplying a fixed displacement motor which drives the load through a gear reduction unit. This transmission uses axial piston type positive displacement pump and motor. Such a drive is used to power shipboard gun mounts. In evaluating performance of a pump and motor to be used in this drive, speeds, torques and other data were obtained. Final conclusions of this study showed that there are hydraulic components available which can meet the tough performance specifications posed by present power drive requirements. However, weight and space required by this equipment is not always as small as desired and the equipment cannot always meet the dynamic performance requirement of the military specifications. Thus on many applications there is a need for a hydraulic transmission which will occupy far less space and weigh less than commercially available equipment. With this as a guiding principle, steps were taken to determine what might be done to obtain the lightweight equipment.

Two avenues of attack are possible. First, greater power capacity per unit volume of material can be obtained by increasing the operating pressure. Second, more horsepower per pound can be obtained by increasing the speed of operation. After careful study of these two alternatives it was decided to attack the problem from the standpoint of increasing speed while holding a reasonable maximum pressure. The problems which arose and their solutions are indicative of the kind of problems which face the pump and motor people in their development of new and advanced equipment.

INCREASE SPEED TO ELIMINATE GEAR REDUCER

For the shipboard application of the drive in Figure 1, if the pump could be operated at 3600 rpm, the need for gear reduction between electric motor and the variable displacement machine would be eliminated. Nature has a tendency to make high speed a difficult goal to attain. Whether it is driving a high-speed aircraft through the sky or turning a pump cylinder at high rotational velocity, difficulties go up at a rate far in excess of the speed.

R. H. MARVIN *was Chief of the Applied Hydraulics Section, Franklin Institute when he prepared this article. He is now associated with The New York Air Brake Company.*

HIGH SPEED PUMPS AND MOTORS

The rolling contact bearings in a piston pump which exerts a high thrust load on a reacting member can pose a problem at high speed. H.A.S. Howarth of the Franklin Institute staff suggested the incorporation of oil film bearings in machines that operate at essentially constant speed. Speed, of course, is required since film-type bearings rely upon speed to induce the fluid films which separate the bearing surfaces.

Figure 2 shows the modifications which were made on an existing positive displacement machine. This is the variable displacement pump of a power drive for a shipboard gun mount. In this design, the socket ring which carries the thrust of the connecting rods is supported by radial and thrust rolling contact bearings. The tilt plate was modified and a new socket ring was constructed so as to accommodate radial and thrust pivoted shoe bearings. Tests run with this new feature were very successful and indicate that the use of film type pivoted shoe bearings in machines which maintain speed can be a real asset. At least one pump manufacturer uses radial and thrust pivoted shoe bearings on a pump.

Film bearings of this type are pretty much restricted to the medium speed range. For applications where the relative velocity is much above 50 fpm, the power losses due to the shearing of the fluid film may become excessive. In the medium speed range they have real possibilities. For hydraulic motors which must operate under load around zero speed, the film type bearing is not adequate since the films are dependent upon speed for their formation.

One cannot always provide the protective film of hydraulic fluid that prevents metallic contact. Pistons in cylinder barrels and valve faces are typical of such cases. In these instances there is a problem of choosing materials which will operate under conditions of mixed or boundary lubrication with freedom from galling and with minimum wear. Starting or running at very low speeds as might be encountered in a hydraulic motor is typical of the operating conditions where fluid films are not fully developed and mixed or boundary lubricated conditions may exist. Material compatibility then becomes a real problem.

CHECKING MATERIAL COMPATIBILITY

As a means of checking out a hydraulic motor for operating conditions, the setup shown in Figures 3 and 4 was devised. It is a stop-start test in which the hydraulic motor accelerates a flywheel from zero to a speed of about 300 rpm under 4000 psi pressure. Having attained this speed the discharge line of the motor is blocked, the input line is opened to a supply of fluid and the energy in the flywheel dissipated by throttling through a relief valve in the discharge line. The cycle is repeated after a period of time long enough to be sure that no fluid film persists from cycle to cycle.

To further check the compatability of materials to run under less than full film lubrication, a brake is applied to the flywheel and with high pressure on the motor, prolonged runs are made at speeds ranging down to 10 rpm. Here again the object is to determine how well the materials which move relative to each other would stand up under conditions undesirable from the standpoint of lubrication.

Going to an extreme as far as hydraulic fluid is concerned may be helpful in selection of materials. For example, the problems of wear and deterioration when using fire-resistant fluids indicate that the pump and motor manufacturers must give

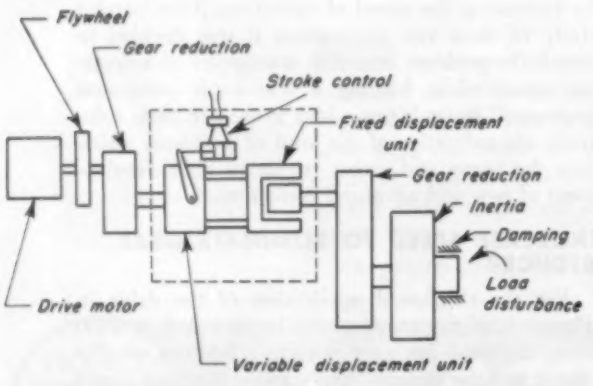

FIG. 1. SCHEMATIC DIAGRAM of a typical power transmission used to drive shipboard gun mounts. Axial piston pump and motor are used.

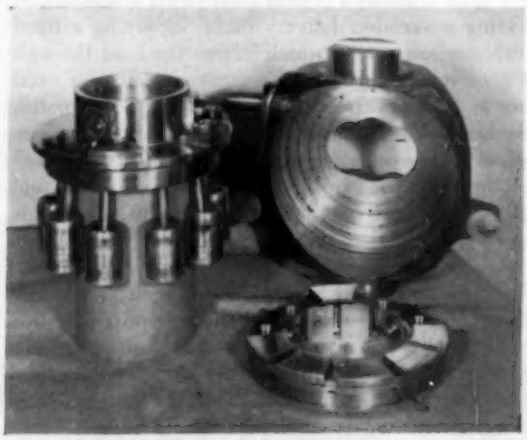

FIG. 2. FILM-TYPE pivoted shoe bearings which have been added to this pump are a real asset on machines which must maintain high speed.

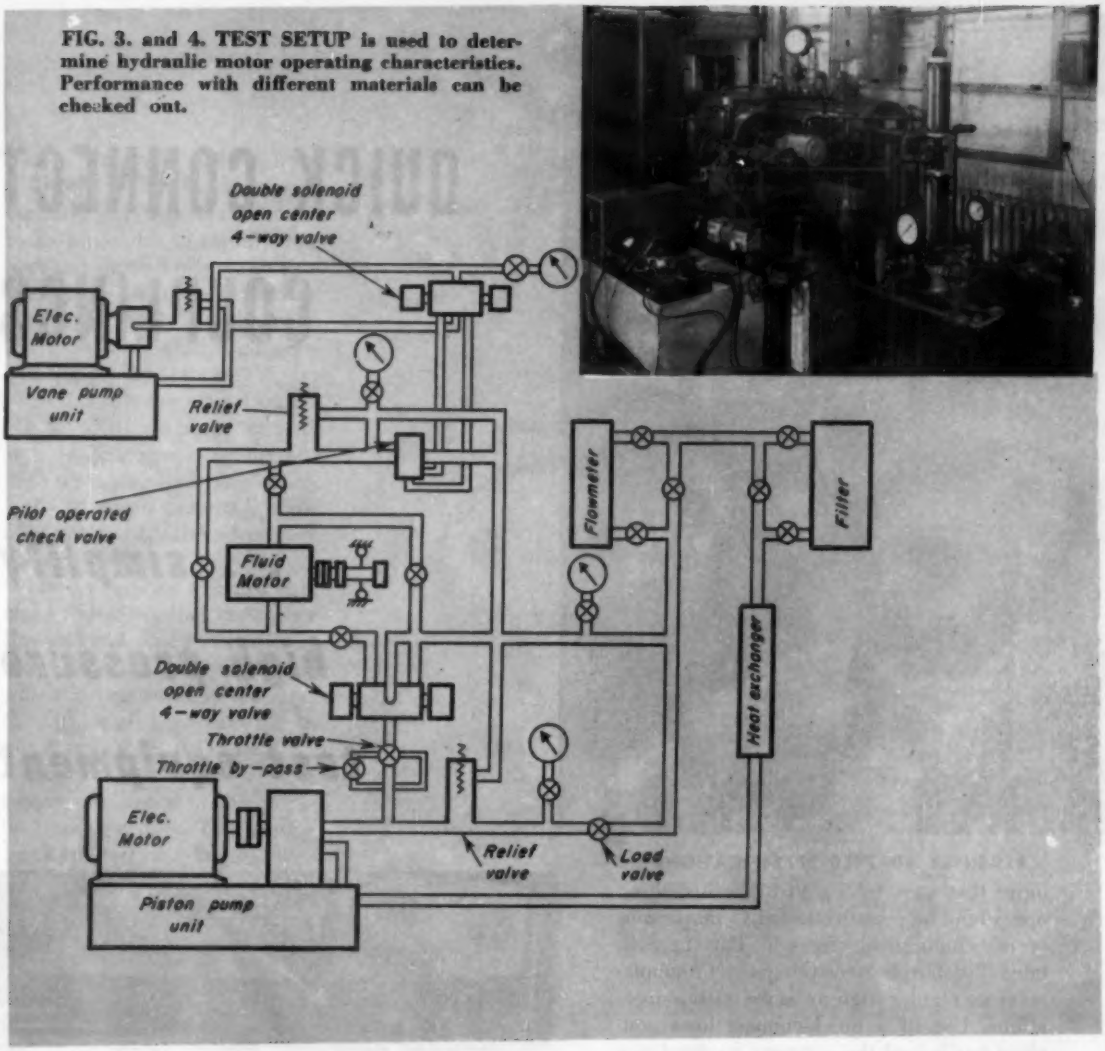

FIG. 3. and 4. TEST SETUP is used to determine hydraulic motor operating characteristics. Performance with different materials can be checked out.

more emphasis to the fundamentals of lubrication in order to give reliability comparable to use with petroleum-base fluids. Lubrication specialists follow the theme that most fluids can be made to form fluid films with proper design. One job has been concerned with the lubrication of a thrust bearing using hot water. Viscosity of water at 200 F is many times less than hydraulic fluid at 100 F. The materials on this job as on the hydraulic pumps or motors have to operate under adverse conditions of lubrication. The bearing had to start under load. This meant that there would be no hydrodynamic fluid film at the instance of starting. The two materials had to operate under conditions of boundary or mixed lubrication with water until the speed was sufficient to form the fluid film. Needless to say, many materials did not pass this crucial test.

One of the chief problems associated with the high speed hydraulic pump and motor operation is the ability to carry the loading of centrifugal origin. For example, on one hydraulic transmission, in development at Franklin Institute, the total radial load which is transmitted by a slipper to a reacting member is 6800 pounds. Of this total load, 2800 pounds is due to a 3000 psi pressure. The remaining 4000 pounds is the centrifugal load. On the basis of the load transmitted, speed could be reduced by one-half and be able to operate at 6000 psi without any additional load on the slipper. This transmission uses a radial type piston pump operating at 3600 rpm and peak pressure of 3100 psi.

At full stroke, the machine delivers 76 gpm at 3000 psi across the pump. This is about 117 horsepower. The weight in prototype design will be approximately 170 pounds. A 100 psi replenishing pressure prevents cavitation. Overall efficiency at peak pressure is about 85 percent. Development of such machines draws heavily upon knowledge obtained from bearing and material studies.

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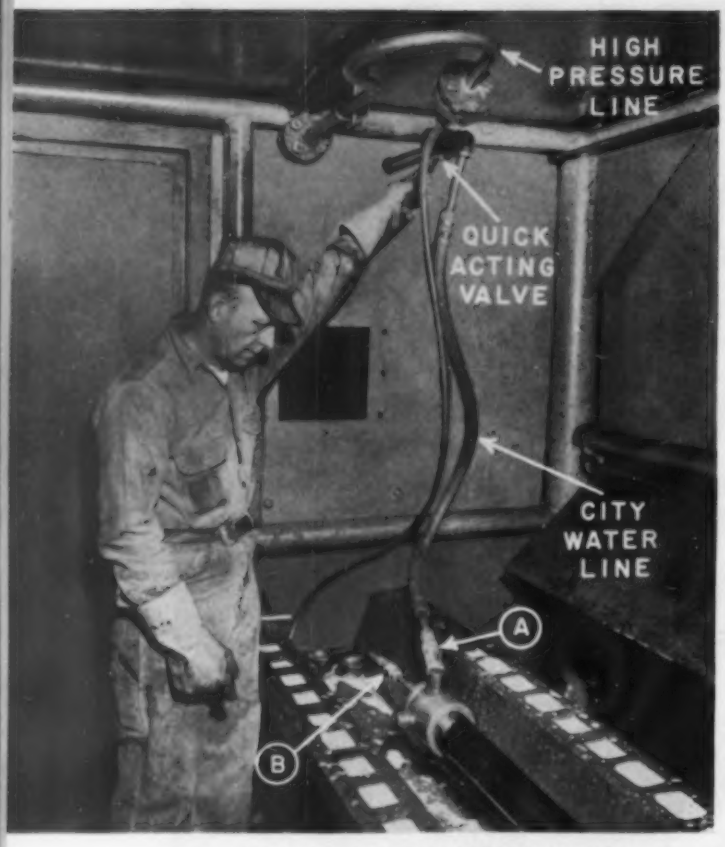
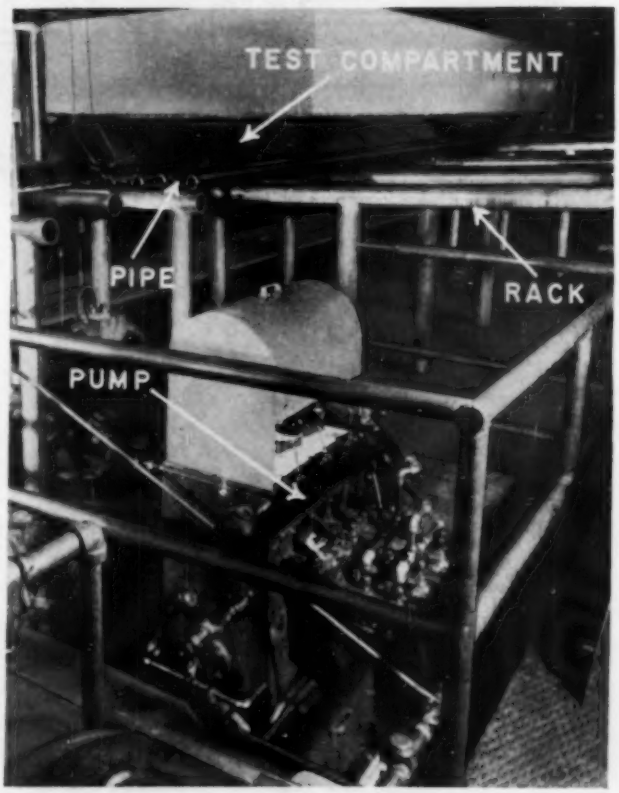


QUICK-CONNECT COUPLINGS

. . . simplify high pressure test equipment

RECENTLY ADAPTED SPECIFICATIONS require that steel tubing in oil well drilling operations be pressure tested to 80 percent of minimum yield strength. This necessitated Pittsburgh Steel Company to supplement its regular high pressure testing operations. Use of a quick-connect hose coupling has helped the company to develop a simple, low-cost, home-made installation. Here, the operator is inside the testing compartment turning the quick-acting valve in city water supply line which fills test pipe. City water supply enters test pipe through double check valve coupling (A). After pipe is filled, high pressure will be developed from pump supply line through quick-connect coupling (B).



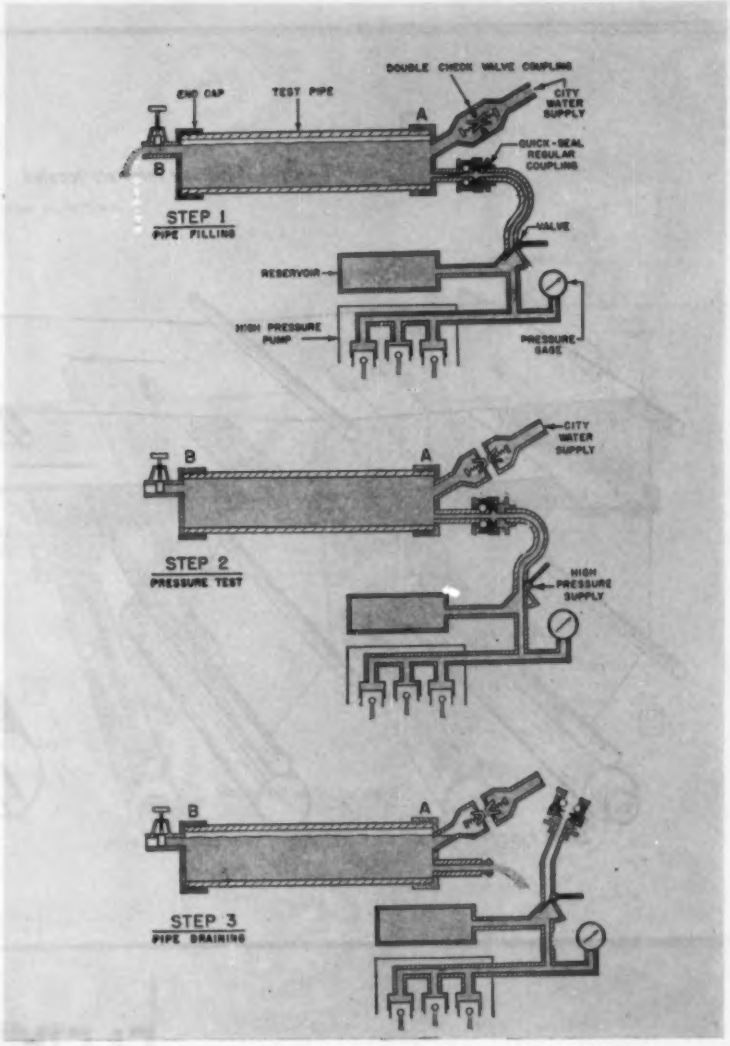
THE HIGH PRESSURE SUPPLY PUMP is located in the pit. In a number of sizes, pressures are tested to as high as 10,000 psi. An inclined rack permits easy movement of pipes into and out of test compartment. The entire test equipment is covered by a protective hood which shields shop and personnel from injury in case of test pipe failure. Total cost for this set-up was very low compared with the cost of standard machines built for this type job.

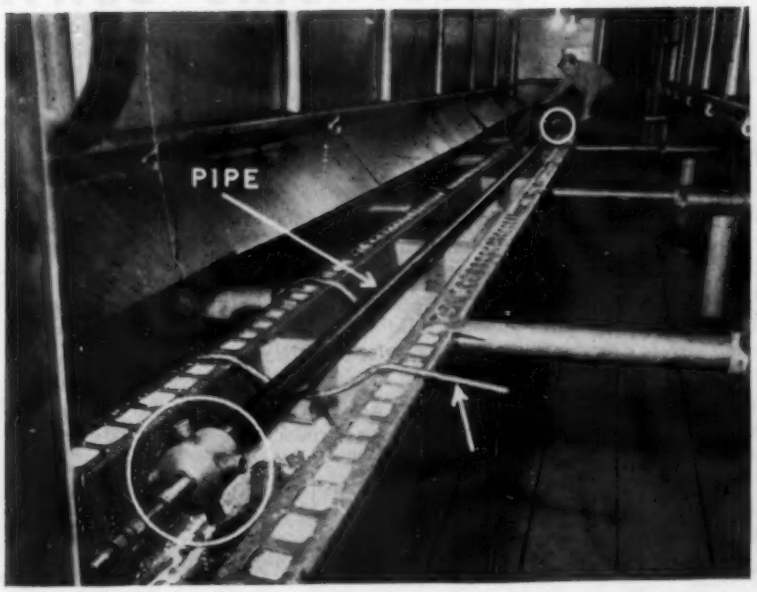
DESIGN DETAILS which were mastered in this arrangement make it possible to rapidly connect and shut-off city water supply, and to switch rapidly from city water supply for filling the test pipe to a small high pressure supply for testing.

Step 1 fills the pipe. Double-check valve coupling in city water supply line is connected; high pressure supply is blocked. Valve at end B permits outflow of water until bubble-free flow shows pipe free of air.

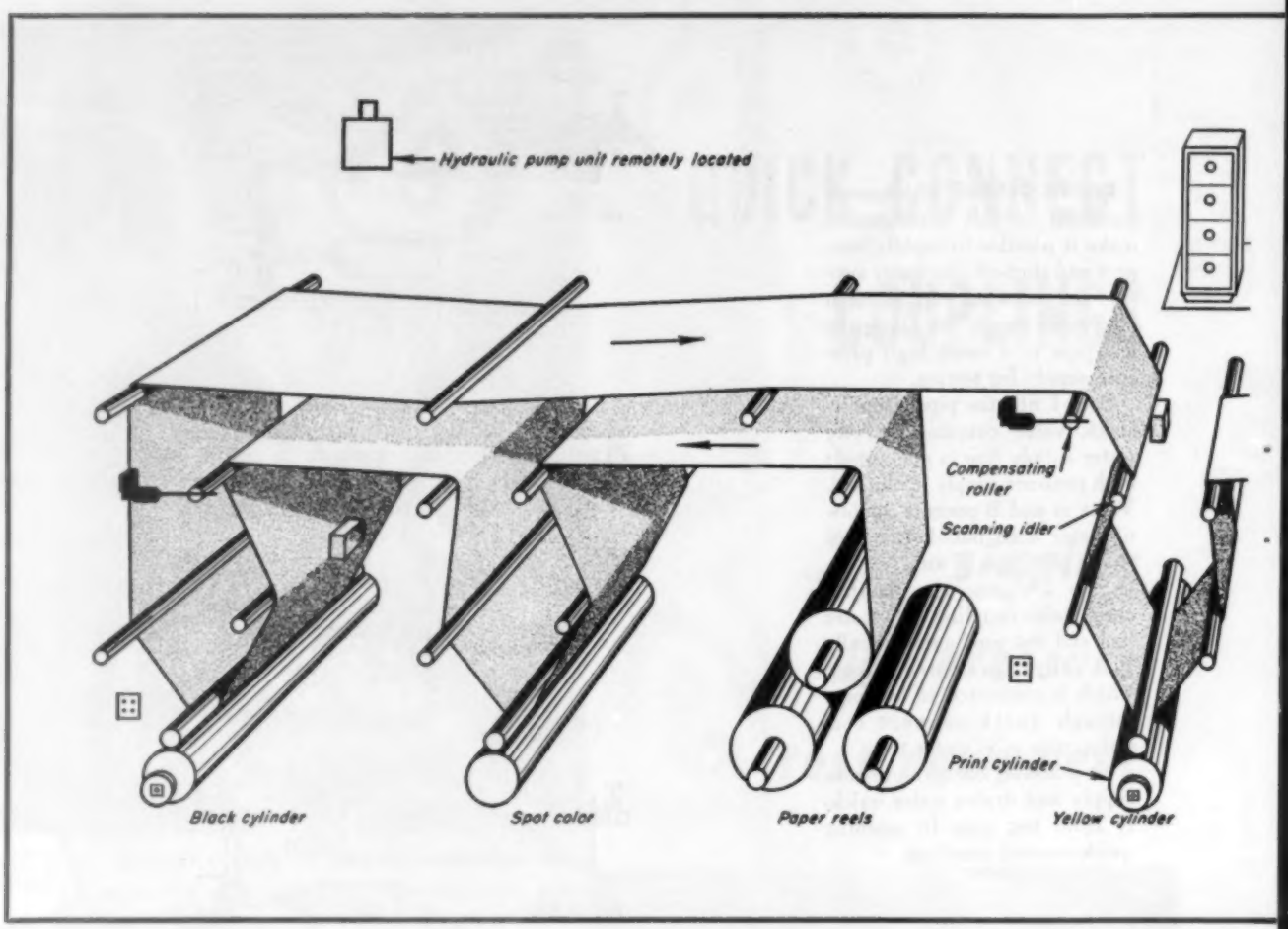
Step 2 opens the double check valve coupling, city water line and test pipe automatically shut. High pressure supply which is connected to test pipe through quick-connect coupling, puts pipe under test.

Step 3 shuts off high pressure supply and drains water quickly from test pipe by opening quick-connect coupling.



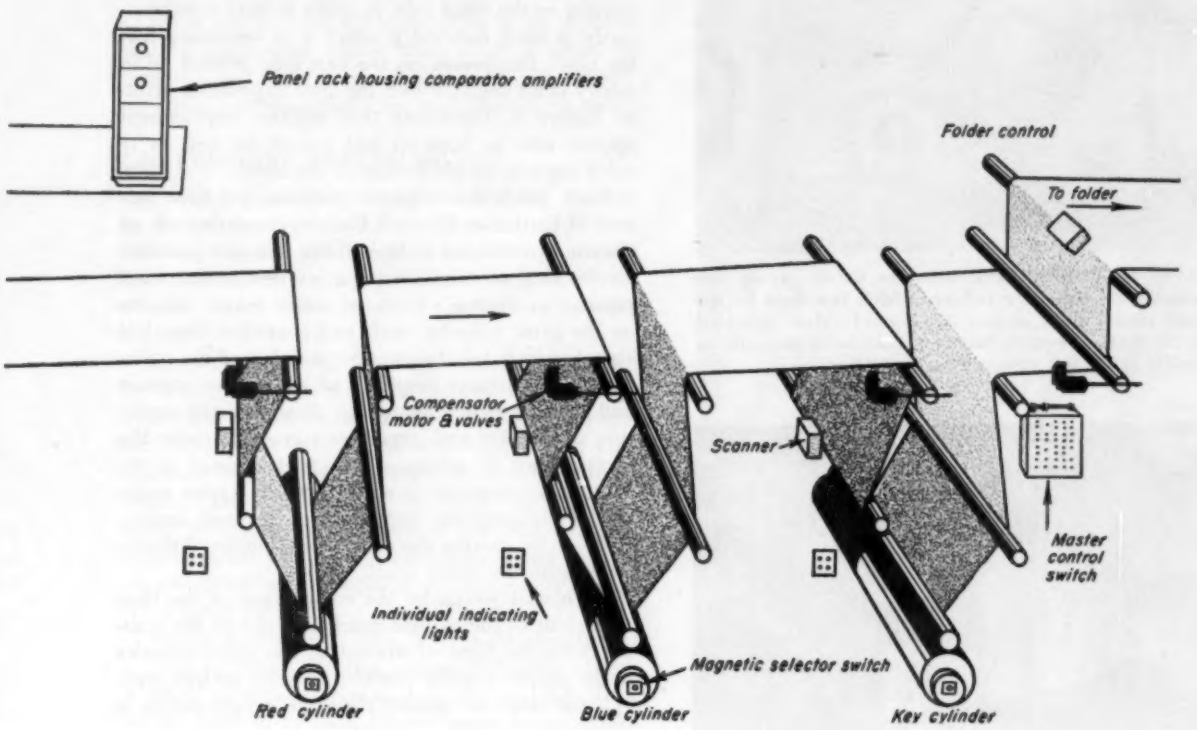


PIPE TO BE TESTED rolls in from right, and out on left by lifting supporting bar ends. Filling and pressure supply connections are made through threaded end caps (circled). Full pressure of 9,700 pounds is kept on for six seconds.



ELECTRONIC CONTROL

HIGH SPEED ROTOGRAVURE PRESS, shown in the layout drawing, prints monotone and spot color on one side of the paper web and three colors and black (key cylinder) on the other side of the web. Getting the colors to properly register is done with an electro-hydraulic system. After the web has passed over the first printing cylinder, the control device must take over to make certain that the web is properly fed into each of the remaining five printing cylinders. To obtain this control, a scanner or electric eye is mounted on an adjustable bracket in front of an idler roll to scan the web just before the web enters each of the color printing rolls after it has passed through the first color printing cylinder. This press uses five electric eyes mounted at each of the scanner idlers. A selector switch or timer is mounted on each of the print cylinder shafts. This switch generates electrical signals which tell the angular position of the printing cylinder. Register can be measured by comparing the position of a color spot as it passes the scanner with the angular position of the next printing cylinder. Electrical signals from the scanner and selector switch are fed into a comparator amplifier which determines the condition of register and generates a signal which causes the hydraulically driven compensator roller to advance or retard register as required. The compensator varies register by changing the length of web between impressions or by moving the controlled cylinder differentially with the drive shaft.



OF FLUID MOTORS

.... maintains accurate register on multi-color high speed printing presses

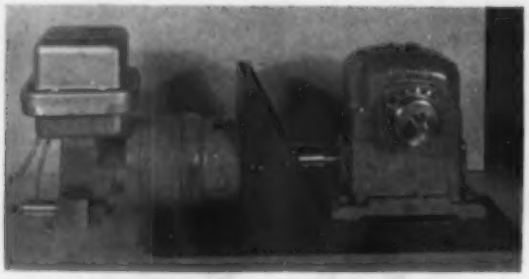
• By Robert C. Booth

LOW inertia axial piston fluid motors respond rapidly to stop or start a load. This rapid response to electronically developed signals is a major factor in the success of "register" control in high speed multi-color printing presses. Response time of the register control system is in the order of .01 seconds. This is the time it takes for the hydraulic motor shaft to respond after and off-register condition exists. Experience indicates that the system will control register on present day presses to within .002 or .003 of an inch.

APPLIED TO A SIX COLOR PRESS

In order to understand the entire process of automatic circumferential register control, it is first necessary to know something about a multi-color printing press. For the purpose of this article we have selected a rotogravure press which prints two colors on one side of the web, and four on the other.

ROBERT C. BOOTH, Assistant Chief Engineer, Electric Eye Equipment Company, Danville, Illinois.



EACH COMPENSATOR idler is driven from the sprocket on this gear reducer which is driven by the axial piston fluid motor. A solenoid valve, mounted on the motor, controls motor operation in response to signals from the comparator amplifier.

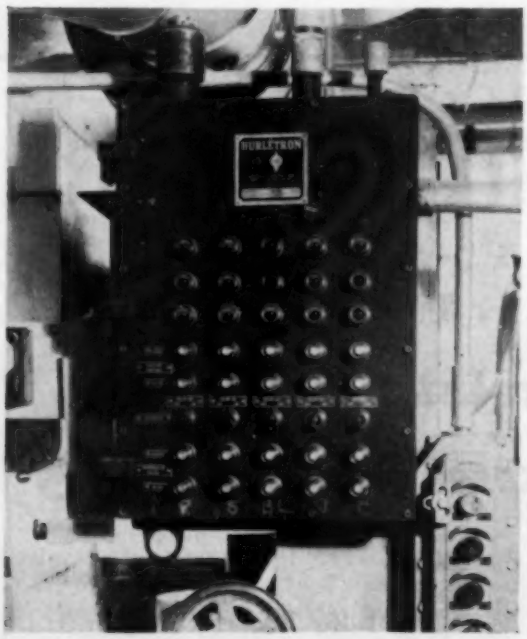
ALONG THE DRIVE side of the press, the five switches are seen mounted on the end of each printing cylinder. Rotating with the cylinder, the switch creates a reference pulse which is compared with the pulse from the scanner.

ONE OF THE FIVE SCANNER units is shown. Scanner slides on a beam so it may be readily moved from side to side. This adjustment permits locating the scanner marks at any convenient place on the web. When the color spot moves in front of it, this photocell transmits a pulse to comparator amplifier.

On this press, shown in the schematic layout, the paper is fed first to the spot color cylinder, and then to the black cylinder. The paper web is then turned over and yellow, red, blue, and key (black) are printed on the other side. In order to have a satisfactorily printed finished product it is necessary that the black impression on the first side printed be in nearly exact register with the spot impression printed before it. Obviously this register requirement applies also to back-up and cut-off as well as to color register on both sides of the sheet.

Each particular register problem requires one unit of Hurletron Register Control consisting of: an electric eye scanner to look at the web and generate an electrical signal whenever a first down color mark passes; a selector switch or timer which mounts on the print cylinder shaft and generates electrical signals which tell the angular position of the cylinder; a comparator amplifier which utilizes scanner and selector switch signals to determine the condition of register and generates signals to cause the compensator to advance or retard register as required; a compensator which actually varies register by changing the length of web between impressions or by moving the controlled cylinder differentially with the drive shaft.

Each unit works by the comparison of the time of arrival of the printed mark in front of the scanner with the time of arrival of the print cylinder at the proper angular position to print perfect copy. If these times are exactly the same, no correction is



THIS MASTER CONTROL has lights in the two top rows which indicate operation of the compensator motors and show the pressman the operation of the overall system at a glance. Shown also are pushbuttons for adjustment of selector switches and switches for changing from manual to automatic control.

necessary, but if they differ, the register must be advanced or retarded rapidly to insure good copy. It is also highly important that the compensator be stopped instantly when good register is restored. If this is not realized, the register variation problem will be aggravated rather than relieved since the compensator would then drive the unit out of register, and a continuous hunting condition would result.

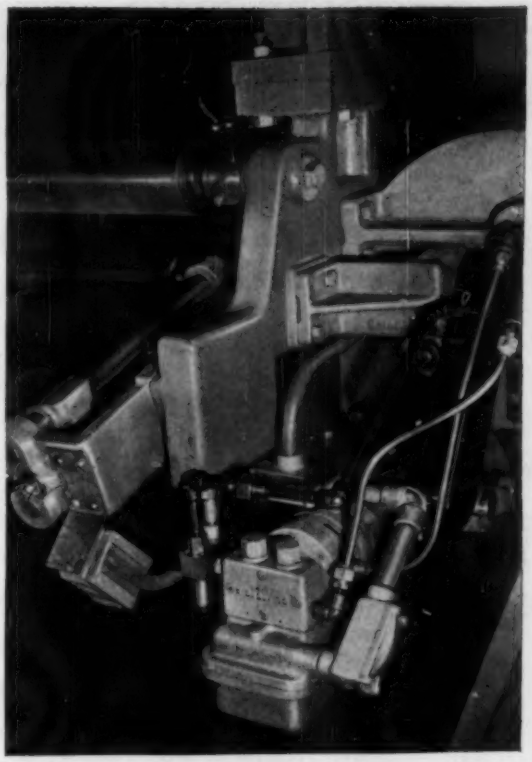
OIL PRESSURE BRAKES MOTOR

To get high torque and instant braking, hydraulic motors are used. Full line pressure is applied to both input ports at all times when it is desired to hold the motor in stop position. One line or the other is closed with a solenoid operated valve when the motor is to run.

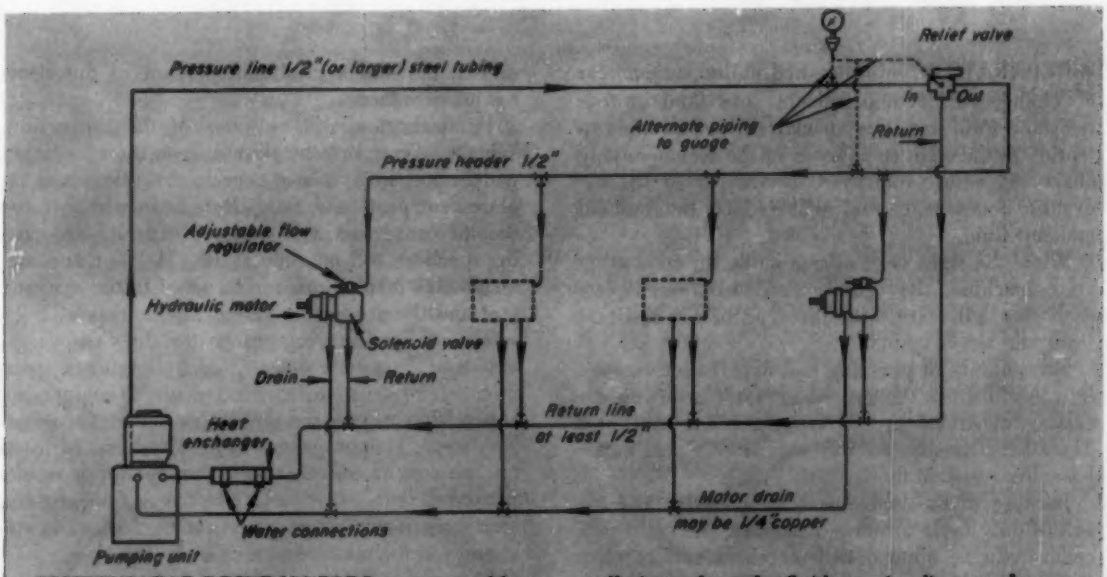
The solenoid valve is energized or deenergized by electrical signals from the comparator amplifier. This valve is face mounted directly to the fluid motor. This keeps each of the five compensator control units in a compact package. All are driven by a single fixed displacement pumping unit. Motor speed is regulated by pressure compensated flow control valves which maintain constant motor speed regardless of load. Torque is determined by system relief valve setting.

Accuracy of register is of course the measure of a good control unit. This electro-hydraulic system is ahead of press design as it could control register within .0005 of an inch. Present press designs make it impossible to take advantage of such fine control.

▼▼▼



COMPENSATING MOTOR controlling one of the folder units. The explosion proof solenoid valve is face mounted on the hydraulic motor. The flow control valve is in the inlet line to the 4-way. The limit switch protects the compensating roller from damage due to overtravel.



COMPENSATOR DRIVE MOTORS are powered by a single fixed displacement vane pump. Pumping unit includes pump, tank, electric motor, relief valve, oil level gauge and pressure gauge. System operating pressure is between 300 to 500 psi. System relief valve is located at the farthest point in the system to aid in cooling the oil. On some installations where the fluid carrying lines are longer than 80 ft, tubing sizes are made greater than indicated. Each fluid motor is a fixed displacement axial piston type having a displacement of .982 cu in per revolution, and will develop a torque of 13.8 in-lbs for every 100 psi.

Photos and drawing courtesy of The Denison Engineering Co.

CHANGING TO FIRE-RESISTANT FLUID?

• By J. R. Hemeon

You'll want to take all necessary steps to properly prepare the machine for a fire-resistant fluid. Taking the right steps will protect your investment in the machine and will insure maximum efficiency of the fire-resistant fluid. Since the fluid will cost you 5 to 10 times as much as the petroleum base fluid you have been using, proper preparation of the machine can save a lot of oil dollars and pump replacement maintenance.

PREPARATION of the hydraulic system for changeover from petroleum base fluid to fire-resistant fluid requires special action. Proper attention to the eight steps listed in the accompanying chart will assure improved service life of the hydraulic components and will reduce the cost of makeup fluid.

While the eight steps offer a guide for converting your machine, the actual procedure to complete each step will vary with the type of fire-resistant fluid and the machine.

Many hours of planning and experimenting went into establishing the procedure for converting die casting machines in the Trenton plant of G.M.'s Ternstedt Division to the use of a glycol-water-base, fire-resistant fluid.

Because of the high operating pressure and the severe duty cycle on these machines, the same procedure can be applied with excellent results when welding machines are converted. Success of the conversion procedure has been measured by good service life and a minimum amount of downtime for maintenance.

Don't short circuit any step of the conversion. What you may save by skimping on the conversion will be lost many times over in downtime and replacement parts and fluid. It is estimated that the cost of converting a 3½ pound capacity die casting machine will be about $1000 in labor and materials. It's a small price in terms of initial machine cost and the production rate of the machine.

The conversion program on the die casting machines at Ternstedt was started by having a spare motor-pump-tank unit converted under engineering supervision to observe the economics of the necessary steps. This program was modified and adjusted on subsequent conversions. After operating results proved the procedure to be effective, a final step-by-step work sheet was prepared for the hydraulic mechanics in the maintenance pipe shop.

• **Cleaning the Tank**—This is done with concentrated caustic solution. A steam jet nozzle is used to add hot water and to agitate the caustic solution. The hot solution which fills the tank is left in the tank until it has dissolved the red tank enamel. After

J. R. HEMEON, *Hydraulic Equipment Engineer, Ternstedt Div. General Motors Corp., Trenton, N. J.*

8 STEPS LEAD TO LONGER SERVICE LIFE AND LOWER COSTS

1. Thoroughly clean the tank and hydraulic system before putting in a fire-resistant fluid. Red enamel must be removed.
2. Increase suction line size and filter capacity on critical pumps to compensate for bulk modulus.
3. Use continuous length suction line to eliminate air leaks from loose elbows and unions.
4. Use new "O" and Vee ring seals which are compatible with your specific fire-resistant fluid.
5. Replace questionable dynamic "O" rings with approved presoaked Vee packings.
6. Use 60 mesh monel metal intake filter screens, in place of usual 100 mesh.
7. Check operation of filters for the formation of filter clogging zinc salt waxes. Eliminate zinc by copper plating.
8. Use a heat exchanger ensemble with the water flow modulating valve set at 115 F.

the tank is drained, a steam jet is used on the sides and baffles; then six or more water rinses are applied until a neutral reading indicates the complete washout of the alkaline caustic solution. The roof of the tank top and the two side and two end cleanout plates are then given a similar treatment to remove the red enamel. If necessary, barnacles and paint are mechanically stripped.

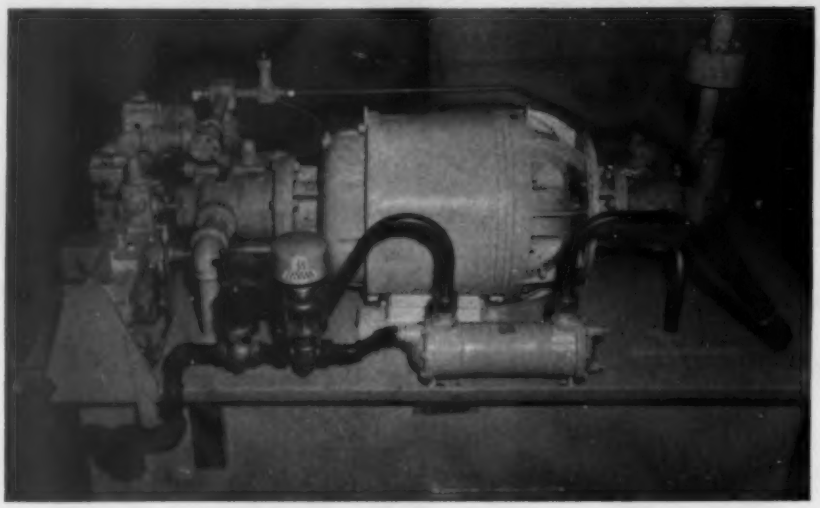
The tank is now ready to reassemble. End clean out plates are permanently placed. At this point, gasket cement is not used on the side plates since they must later be removed for clean out of the flushing fluid. The oil level gauge is overhauled and new gaskets installed. Clean magnetic plug assemblies are anchored in the bottom of the tank.

• **Pump Care**—Vane pumps used on these die casting machines are rebuilt with complete new cartridges, head gaskets and seals. To prevent pump damage due to a dry, tight start, pump cartridge parts are pre-soaked in the fire-resistant fluid. Neglecting this step has resulted in premature pump failure. With the pump flange mounted to the motor, the armature is manually rotated to check pump head tightness. The suction line to a two stage pump on this job is increased from 1 inch to 1¼ inch. This is done to compensate for the change in bulk modulus and to insure a minimum intake manifold depression of the operating fluid. The increased suction line diameter minimizes pump cavitation, and erroding implosion at pump sector cross over, suction to delivery.

• **Packings**—That everpresent problem of compatibility with the working fluid requires a check of the packings. On this machine, valve "O" rings have to be replaced with rings of a different compound. Also the shot piston rod seal and die close rod seal are rebuilt with new Vee packings which have been presoaked for 24 hours in the fire-resistant fluid.

Because there is much more tear resistance in teflon than vellum, thin vellum gaskets, used as seals between the body and caps of many valves, are replaced with gaskets cut from .005 inch teflon sheet when converting a machine for use with a fire-resistant fluid.

• **Suction Filters**—In the initial stages of investigation of die casting machine performance with



MOTOR-PUMP-TANK UNIT after conversion for fire-resistant fluid. New heat exchanger ensemble is in the foreground. It includes "Y" strainer, solenoid operated water shut-off valve, a flow modulator and the heat exchanger.

fire-resistant fluids, it was found that standard 100 mesh zinc plated wire filters became clogged and the pump starved within 100 hours. Formation of zinc salts and irreversible fatty wax like compounds caused the clogging. These investigations have resulted in modifications of the suction filter. End caps, protective grid screen, coupling nut and central core are now copper and nickel plated. The screen element now used is 60 mesh (262 micron openings). With the 60 mesh opening it is essential that magnetic plug assemblies be strategically located in the oil flow path in the tank. The plugs trap abrasive particles which would otherwise pass through the filter screen and rapidly wear the pump ring.

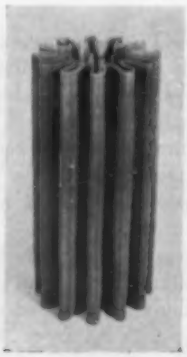
• **Heat Exchanger**—Because the water base fire-resistant fluids have a high incidence of leak when hot, it is necessary to control the stabilized sump fluid temperature at an economic 115°F. A heat exchanger must be used when there is insufficient air radiation to maintain the safe sump temperature.

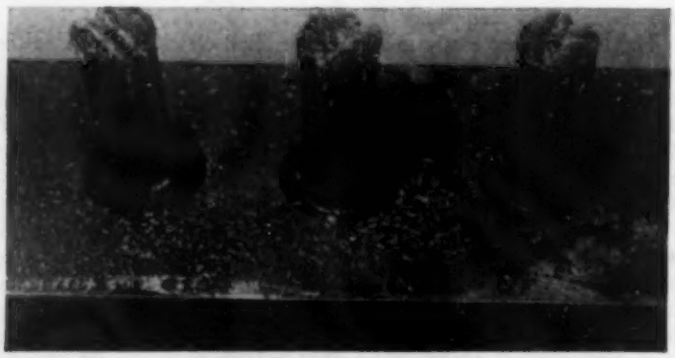
The heat exchanger ensemble used on these installations has been engineered to obtain the maximum temperature protection with the lowest gpm of water consumption. Water flow to the cooler passes through a "Y" branch strainer, a shut-off valve and a flow modulating valve. The solenoid operated shut off is wired across the pump motor. When the motor is stopped, the valve closes and there is no wasteful water after-flow, waiting for the modulating valve to close. The valve also is used to prevent water pressure from cross leaking into the oil tank, if there is a small crack in the cooler.

The flow modulating valve is adjusted at 115°F. The bulb extension is located at correct height in the tank.

• **Starting Up The Machine**—With the con-

Concluded on page 105





SCREEN TYPE FILTER for use with fire-resistant fluids has no zinc plated parts. End caps, protective grid screen, coupling nut and central core are copper and nickel plated. The monel screen element is a 60 mesh. With this course mesh filter, it is necessary to use magnetic plugs in the tank. These plugs were photographed after 5000 hours of operation. It is estimated that pump life has been tripled by the proper use of these plugs. One or more of these assemblies may be placed in the reservoir.

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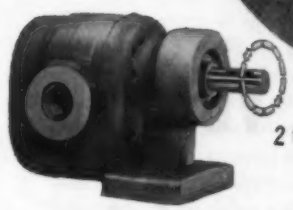
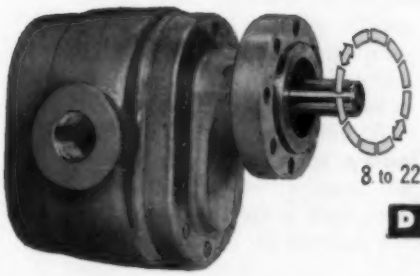


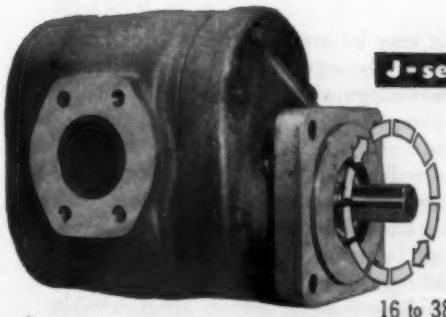
2 to 6 HP*

C-series



8 to 22 HP*

D-series



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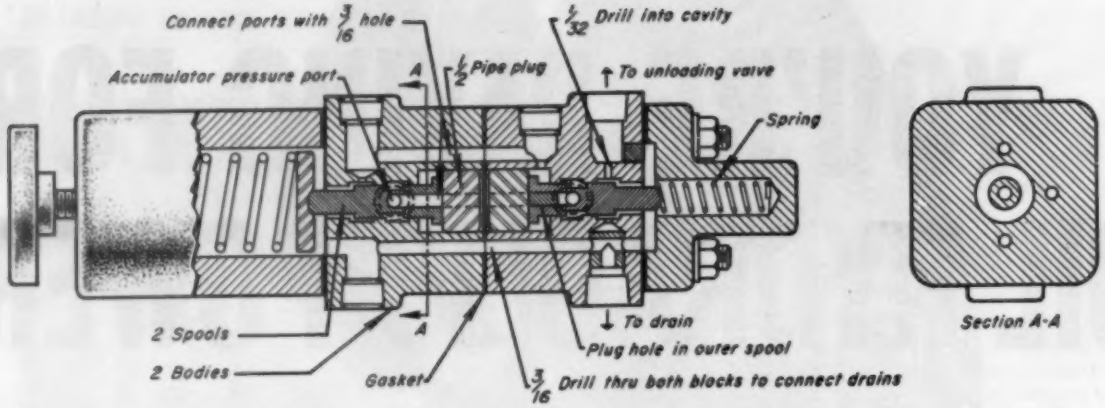


FIG. 1 SPECIAL VALVE includes a relay valve with an adjustable spring and a 3-way valve with a fixed low force spring. Dumping pump delivery at zero pressure is assured to eliminate a source of power waste and heat generation.

HOW TO UNLOAD A PUMP'S FULL VOLUME

... when using an accumulator

• By Fred A. Dahlman and Don J. Tingley

PUMP unloading at zero pressure after an accumulator has been charged can be done with oil actuated or electrically actuated valves. Doing the job electrically is effective. Use of pressure switches which actuate solenoid valves to provide positive "cut-in" and "cut-out" control of the pump in an accumulator circuit was detailed in an article by R. P. Esser, June 1954, pg 68, APPLIED HYDRAULICS.

On accumulator circuits which do not have electrically controlled directional valves, the designer usually does not wish to add an electrical control system just to unload the pump. He wants to unload the pump hydraulically. Even where he does already have electrical controls, a satisfactory hydraulic unloading circuit may be preferred because of lower cost. The electrically actuated unloading circuits do have the advantage of greater flexibility in the selection of pump "cut-in" point as accumulator pressure drops.

With a hydraulically actuated unloading circuit there is a fixed differential between "cut-in" and "cut-out". This fixed differential of about 20-40 psi is good enough for many jobs. The problem is to provide unloading at zero pump pressure.

Many hydraulic unloading circuits are unreliable and result in unloading pressures anywhere from near zero psi to near the working pressure. Some unloading circuits require several valves and much piping which increases the number of possible leakage points.

A good unloading circuit will dump the pump at zero pressure to save power and eliminate a large

FRED A. DAHLMAN *and* DON J. TINGLEY, *Mechanical Engineering Department, Corning Glass Works, Corning, N. Y.*

source of oil heating.

One very effective solution to this unloading problem has been worked out by the Mechanical Engineering Department at Corning Glass Works. The result of their development work is the special valve shown in cross-section in Figure 1. A close study of the operation of unloading circuits shown in Figures 2 and 3 led to the construction of this valve which is shown schematically in a complete unloading circuit in Figure 4.

RELAY VALVE OPERATION

An essential part of these unloading circuits is a relay valve which is a spring loaded hydraulically controlled 3-way valve. System pressure acts against one end of the spool while adjustable spring pressure is applied against the other end. When the system pressure exceeds the spring pressure, the spool shifts slowly, permitting oil to flow from the pressure port to the control port. In the circuit shown in Figure 2, the control port of the relay valve is connected to the control port of the unloading valve. Such systems are not reliable, because the slow shifting of the spool results in a high pressure drop across the spool so that pressure on the unloading valve is not high enough to cause full opening of the valve. With the unloading valve only partly open, the pump must develop a high pressure to circulate oil through the valve back to tank.

REASON FOR PRESSURE DROP

An explanation of the pressure drop across the relay valve is shown in Figure 5. System pressure "P" acting on the effective area of the spool, produces a force that is counteracted by spring "A." A pressure "P" can be reached that will push the spool to the point where port "C" is closed off from the drain port. At this point, pressure starts to build up at "C" due to leakage from "P" to "C". Port "C" is connected to the under side of the spool in an unloading valve.

When the pressure in "C" reaches the spring setting of the

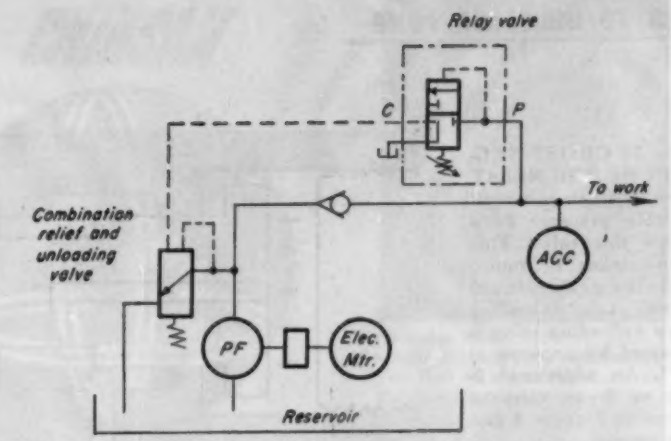


FIG. 2. RELAY VALVE shifts in response to system pressure to apply opening force to the unloading valve. This circuit will seldom unload the pump at zero pressure.

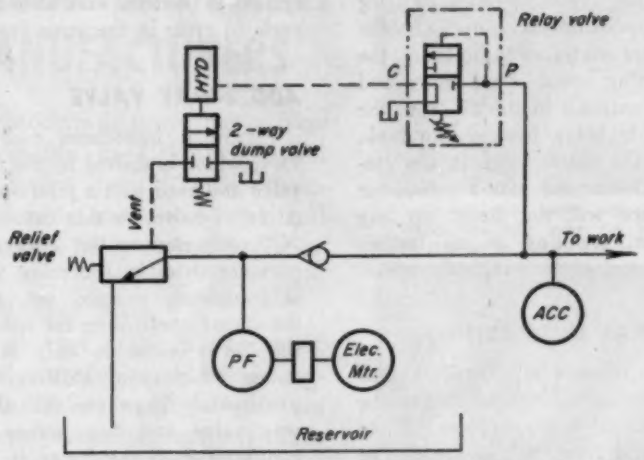


FIG. 3. USING THE RELAY VALVE to open a 2-way valve which vents a relief valve for pump unloading is effective.

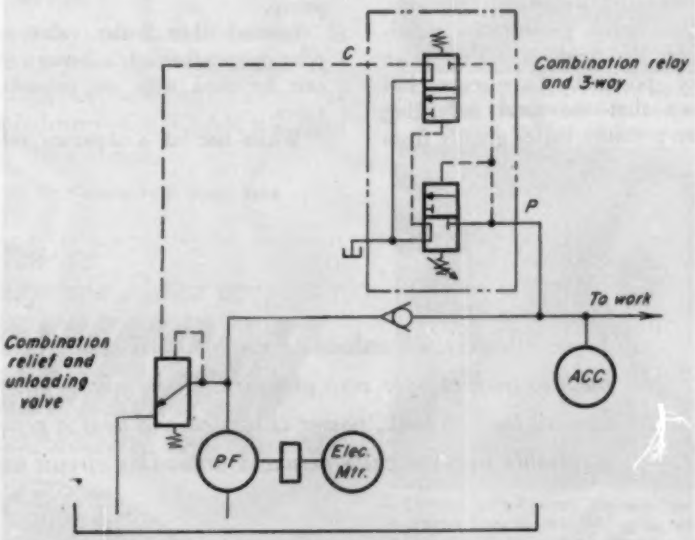


FIG. 4. BY COMBINING a 3-way valve with the relay valve, piping is reduced in this pump unloading circuit.

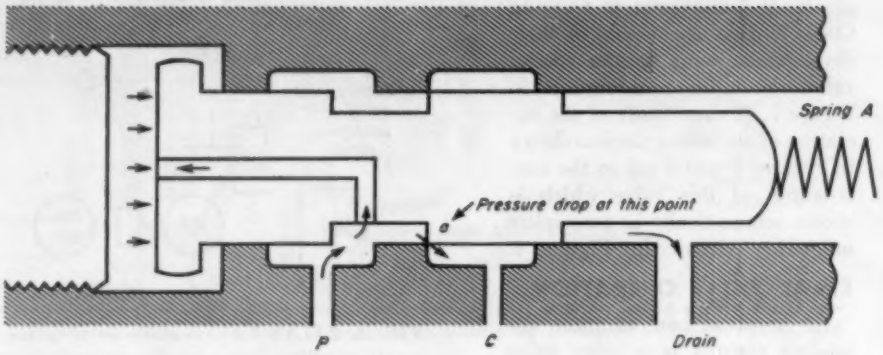


FIG. 5. CROSS-SECTION OF THE RELAY valve shows the cause of variable pressure drop across this valve. This drop makes it impossible to get reliable "zero" pump unloading if an unloading valve is actuated by pressure at "C". An additional 2-way or 3-way valve as shown in Figures 3 and 4 is needed.

unloading valve the unloading valve spool begins to open. As the pressure continues to build up, the unloading spool opens more and more until all of the oil from the pump is being bypassed to tank. Then the check valve in the system closes and the accumulator pressure will not build up any further, resulting in no further movement of the relay valve spool.

PARTIAL UNLOADING

The pressure in "C" will stabilize at some low value depending on the amount of leakage from "P" to "C" and from "C" to drain. The final position of the unloading valve spool is dependent on where the pressure stabilizes. Similarly, the final pump pressure is dependent on the final unloading valve spool position. Experience has shown that the final unloading pump pressure varies greatly from system to system, and also from cycle to cycle in the same system.

ADD 2-WAY VALVE

Figure 3 introduces a 2-way valve which is shifted by the relay valve and used with a pilot operated relief valve. In this case, with "C" connected to the 2-way, the pressure drop in the relay valve is completely shunted out, since the spring controlling the spool of the 2-way valve is only strong enough for spool shifting. Approximately 50 psi can shift the 2-way valve and flow across "a" continues until the 2-way is fully open. The fully open 2-way valve vents the relief valve to dump the pump.

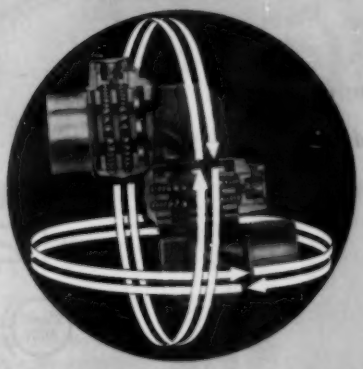
Instead of a 2-way valve and pilot operated relief, a 3-way valve can be used with an unloading valve.

While use of a separate relay valve with a 2-way or 3-way valve will operate successfully, use of the separate valves requires additional piping and joints which increase the possibility of leakage. The valve shown in Figure 1 combines the relay valve with a 3-way valve. A combination can also be made with a 2-way valve. Figure 4 shows the combination valve in a circuit. In this circuit, when system pressure reaches the relay valve setting, the valve shifts causing the 3-way to open and permit pressure from the accumulator to act on the unloading valve. The unloading valve stays fully open until accumulator pressure drops about 20-40 psi and the relay valve closes.

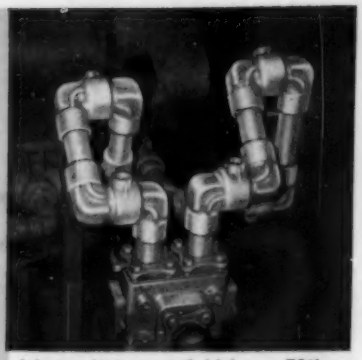
This circuit minimizes the required piping and accomplishes pump unloading at zero pressure when system pressure is at a value higher than the relay valve setting. ▼▼▼

To be effective, an unloading circuit must result in dumping the pump delivery back to tank at near zero pressure. If the pump must develop pressure to circulate oil back to tank, power is wasted and heat is generated. This article tells how a reliable hydraulically actuated unloading circuit was developed.

CHIKSAN



Chiksan swivel joints in landing gear, braking and hydraulic control systems on Lockheed's Super-Constellation.



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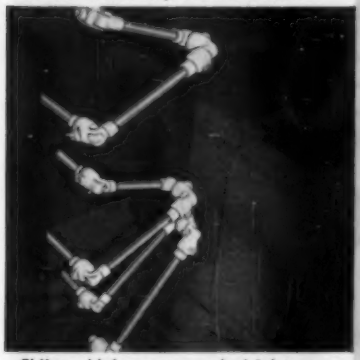
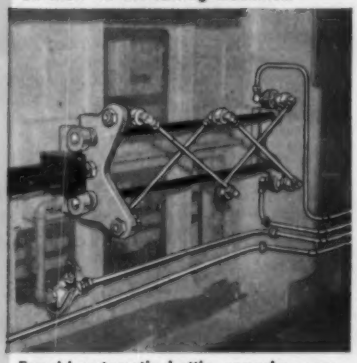
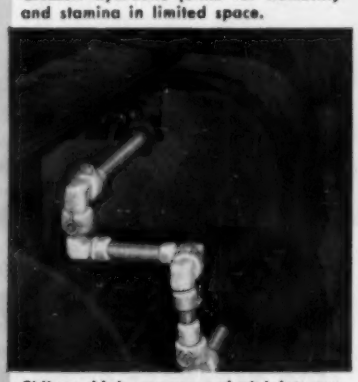


Chiksan high-pressure swivel joints provide complete flexibility and safety in steam lines on platen presses.



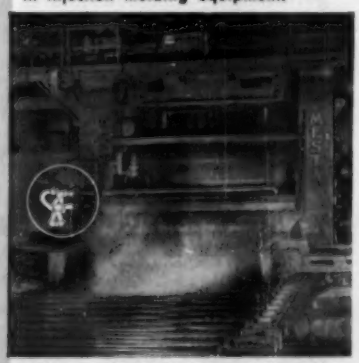
Ermold automatic bottle unpacker uses Chiksan hydraulic joints for flexibility and stamina in limited space.

Most hose reel manufacturers employ Chiksan swivels for pressure and vacuum tight connections with low torque.



Chiksan high-pressure swivel joints are installed for dependability and safety in injection molding equipment.

Colorado School of Mines turned to Chiksan swivel joints for air and hydraulic lines on shale mining equipment.



Chiksan swivel joints are used on the coolant lines on the 160" plate mill in U. S. Steel's Homestead Works.

The Flow of Enterprise Relies on

CHIKSAN

Ball-Bearing Swivel Joints

CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 28, Illinois • Newark 2, New Jersey

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Chiksan Export Company (Subsidiary), Brea, California • Newark 2, N. J.

Fine control of speeds on a hydraulic system is very difficult when there is considerable variation in load. To obtain excellent speed regulation of a rotary fluid motor, this circuit is designed to . . .

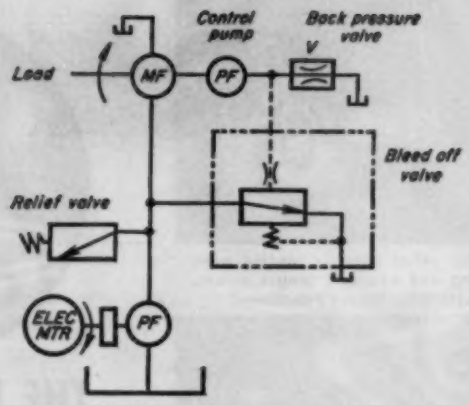


FIG. 1. Fluid motor speed regulating circuit

ELIMINATE SLIP AND COMPRESSION EFFECTS

• By J. R. Fawcett

ON many oil driven machines, as the pressure varies, the effective output of the pump is altered by slip and compression of the oil. This change in pump output can cause speeding up with light loads and slowing down as the load increases.

To overcome this cause for speed variation, a completely separate hydraulic system is used for control. This additional circuit gives a degree of control comparable with the most elaborate governing systems and suitable for many applications where precision speed control is essential.

A fixed capacity pump and motor are used for the main drive. The pump must be of sufficient capacity to drive the motor at the highest speed and load likely to be encountered, due allowance being made for electrical and hydraulic slip. The actual speed control is carried out with the small pump driven by the hydraulic motor and discharging to tank through a variable orifice type flow control valve. For any given setting of the flow control valve there will be a speed of the motor where the pressure between pump and valve will be a predetermined value—say 30 psi. If the motor speeds up, the pump output will increase and the pressure will rise slightly; if the motor speed falls, the reverse action takes place. This pressure is applied to the special bleed-off control valve shown in Figure 2 which passes the surplus delivery from main pump to the tank. The valve is kept partially open by the pilot pressure, allowing sufficient oil to escape to maintain correct delivery to the motor. By using a control spring of sufficient length the change of pressure required to open or close the valve can be made very small.

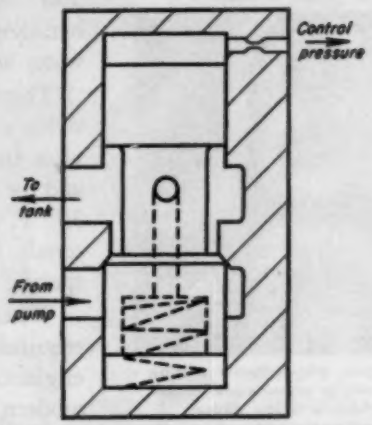
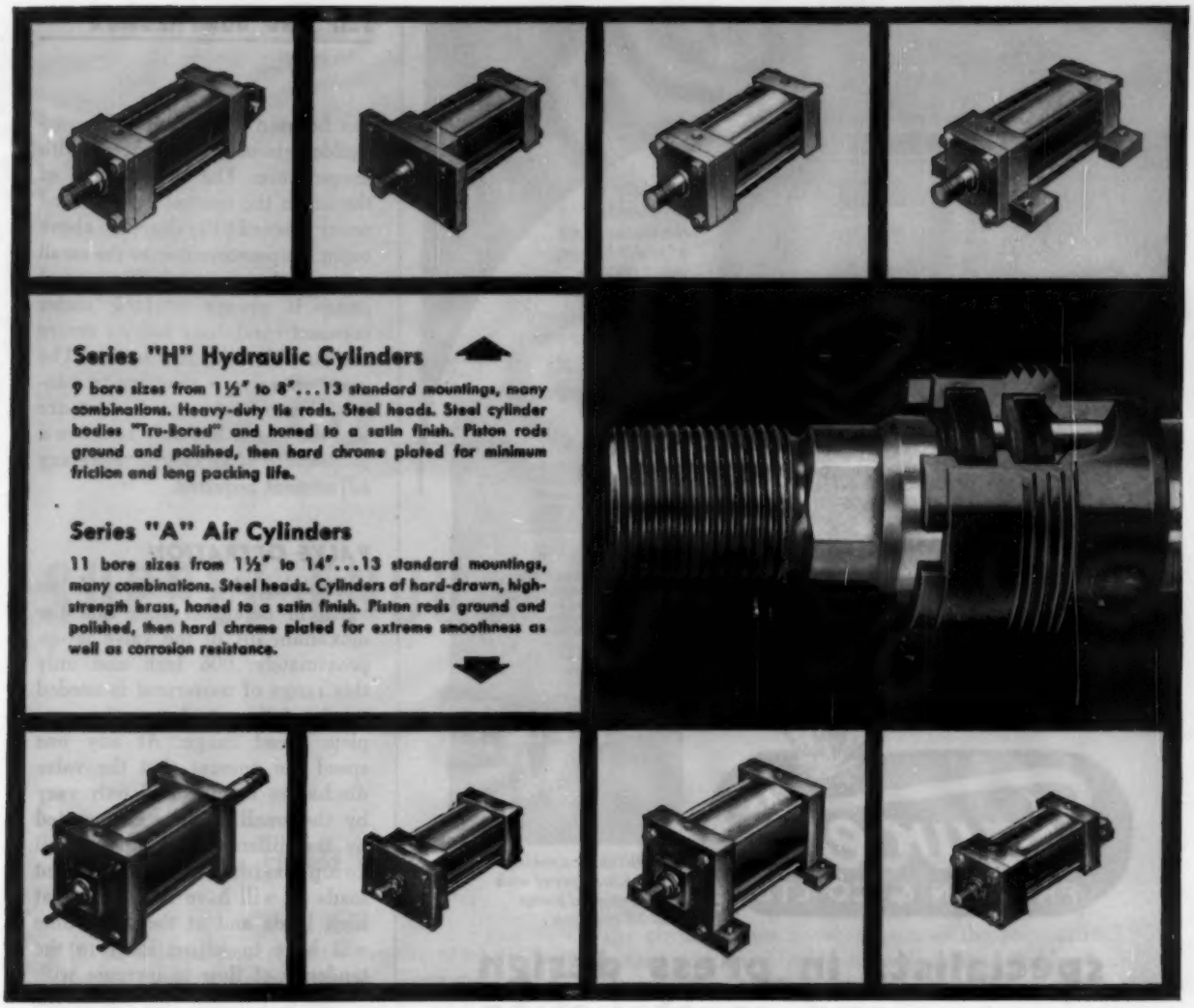


FIG. 2. Detail of the bleed-off valve.

The adjustments which have to be made to the flow when running at any one speed are small, as only variations in electric motor speed and allowances for variations in pump output and motor slip at different pressures have to be made. It will be clear, therefore, that very close control can be obtained for the following reasons. The control pump is operating at a pressure of only 30 psi and it



Series "H" Hydraulic Cylinders

9 bore sizes from 1½" to 8"...13 standard mountings, many combinations. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished, then hard chrome plated for minimum friction and long packing life.

Series "A" Air Cylinders

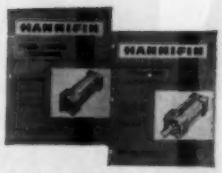
11 bore sizes from 1½" to 14"...13 standard mountings, many combinations. Steel heads. Cylinders of hard-drawn, high-strength brass, honed to a satin finish. Piston rods ground and polished, then hard chrome plated for extreme smoothness as well as corrosion resistance.

Only HANNIFIN Square-Type Cylinders Have This Revolutionary New Gland

The gland you see here represents the biggest improvement in cylinder design in the last 50 years. And, you'll find this gland only in Hannifin Square-Type Air and Hydraulic Cylinders.

This exclusive Hannifin Gland is a bronze cartridge, *externally removable and replaceable as a unit* to meet J.I.C. recommendations. The packing is new, too. Outside is the "Wiperseal." It serves a dual purpose as it *wipes both ways* to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. Inside is the "Lipseal"...self-compensating, self-relieving and nonadjustable. It provides an efficient seal throughout its long life.

Find out how easily you can apply Hannifin Cylinders to your requirements. They're available for prompt delivery—in all sizes and all standard mounting styles—and at competitive prices despite all their exclusive features.



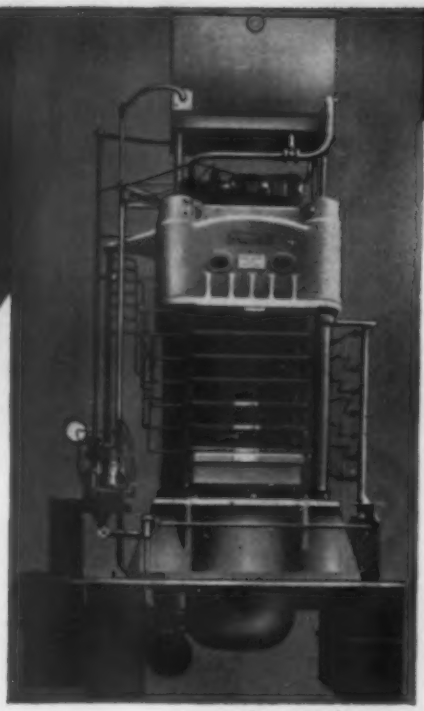
WRITE FOR BULLETINS

Bulletin 113. Series "H" Hydraulic Cylinders

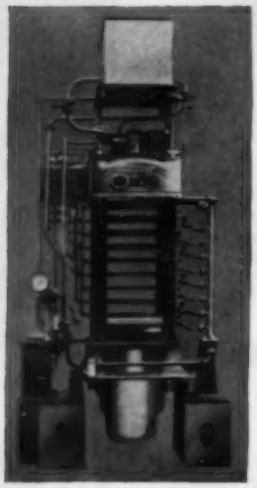
Bulletin 213. Series "A" Air Cylinders

HANNIFIN

Hannifin Corporation, 545 S. Wolf Rd., Des Plaines, Ill.
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves



Specially designed for the manufacture of brake linings, this 2,000-ton upstroking press has a self-contained motor-driven pump and oil reservoir.



A 500-ton upstroking multi-platen press with self-contained pump and oil reservoir.

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PRESTON & CO LTD.

specialists in press design and construction

We specialize in the design and manufacture of presses for special purposes and production techniques. Wide experience of the needs of industry enables us to build hydraulic presses for widely varying duties. If you have a special pressing or baling problem, Fawcett technicians can adapt a standard machine to your specifications or, if required, design an entirely new press to fit your production requirements.

A hydraulically operated testing rig with electric motor-driven pump.

FAWCETT PRESTON & CO LTD
BROMBOROUGH CHESHIRE TEL ROCK FERRY 2201 (5 LINES)
A METAL INDUSTRIES GROUP COMPANY

FPB/C/1608

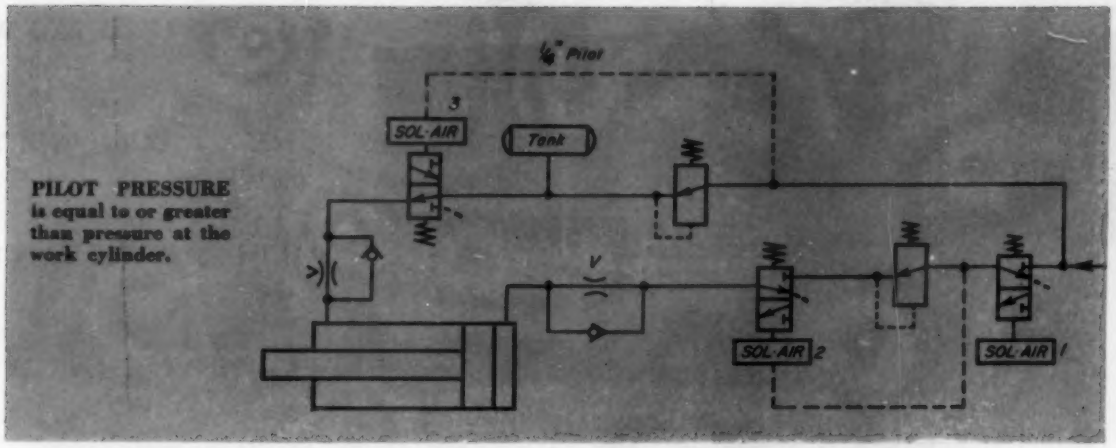
can be used on thin oil with negligible viscosity variations with temperature. The temperature of the oil in the control system need never exceed 10 degrees above room temperature due to the small amount of power used. The control pump is always working under constant conditions and no errors are possible from this source. The bleed-off valve is sensitive to minute changes of control pressure and the piston has only to move a thousandth of an inch to make any adjustment required.

VALVE OPERATION

Studying the operation of the valve in detail we find that the maximum lift of the valve is approximately .005 inch and only this range of movement is needed to give full control over the complete speed range. At any one speed the amount that the valve discharges to tank will only vary by the small amount represented by the difference of slip and oil compression for the different loads. It will have to pass less at high loads and at the same time will have to adjust itself to the tendency of flow to increase with pressure. For any one speed, the amount of movement is unlikely to exceed .002 inch.

Like all other governors without a reset feature, there must be a slight change of speed when the load alters. If it is assumed that the plunger moves a maximum of .002 inch for load altering from zero to full at any one speed, then an accuracy of one tenth of 1% would be obtained if the control spring is compressed .002 inch x 1000=2 inch. This gives a mean variation of one twentieth of 1%, an amount far too small to be detected except by precision methods of speed control. In practice it is unlikely that the load would alter over the full range while constant speed is required.

Most sensitive speed governors are subject to hunting unless precautions are taken and in this case damping is provided by the restriction in the control line which prevents piston flutter. ▼▼▼



SUPPLY ENOUGH PILOT PRESSURE

to operate poppet type valves

• By Harold Kruer

ALL directional control valves require some operating force to change position. When manually operated or direct solenoid operated valves are used, the machine circuit designer doesn't have to give much thought to the required actuating force. He can safely assume that the manual valve he purchases will not have friction forces which make it difficult to position. Also he relies on the manufacturer of a directly operated solenoid valve to build a valve that properly shifts.

However, if solenoid controlled-pilot operated poppet air valves are used, the designer must be aware of the forces required for shifting. These valves have many applications and of course are used very successfully on jobs where the circuit designer has provided adequate pilot pressure to insure valve operation with varying main line pressure.

Why does the poppet-type valve require this consideration? Unlike the spool type valve, the poppet valve is not pressure balanced. This means that main line pressure acting on the poppet opposes the force developed by pilot pressure. Therefore, to be sure that the valve will shift when pilot pressure is applied, this pressure must develop a force which is greater than the forces opposing poppet movement.

It is a simple matter to provide sufficient pilot pressure if the air circuit is carefully thought out. The circuit shown above is part of the pneumatic system on a machine built by Precision Welder & Machine Co. The circuit shows how pressure control is maintained regardless of variations in main line pressure. The solenoid controlled-pilot operated valves used on this machine require a minimum pilot pressure of 30 psi. When main valve pressure exceeds 30 psi, pilot pressure must be equal to or greater than main line pressure.

Independently regulated pressure is required on the rod and blank ends of the actuating cylinder. This calls for pressure regulators placed in the lines ahead of the 3-way directional control valves. Running an external pilot line upstream from the regulator keeps pilot pressure always at the highest possible value. There can not be any faulty valve action in this circuit due to insufficient pilot pressure.

What's the small tank in the rod end line for? During the feed portion of the forward stroke, solenoid 2 is energized so that there is air pressure on both the blank and rod ends. The piston advances because of the differential areas. Air out of the rod end must have someplace to go. The tank fills this need. Near the end of the forward stroke, solenoid 3 is energized to exhaust the rod end and permit rapid motion of the piston. Piston reversal is accomplished by deenergizing both valves 2 and 3.

▼▼▼

HAROLD KRUER, *Chief Engineer, Precision Welder & Machine Company, Cincinnati, Ohio*

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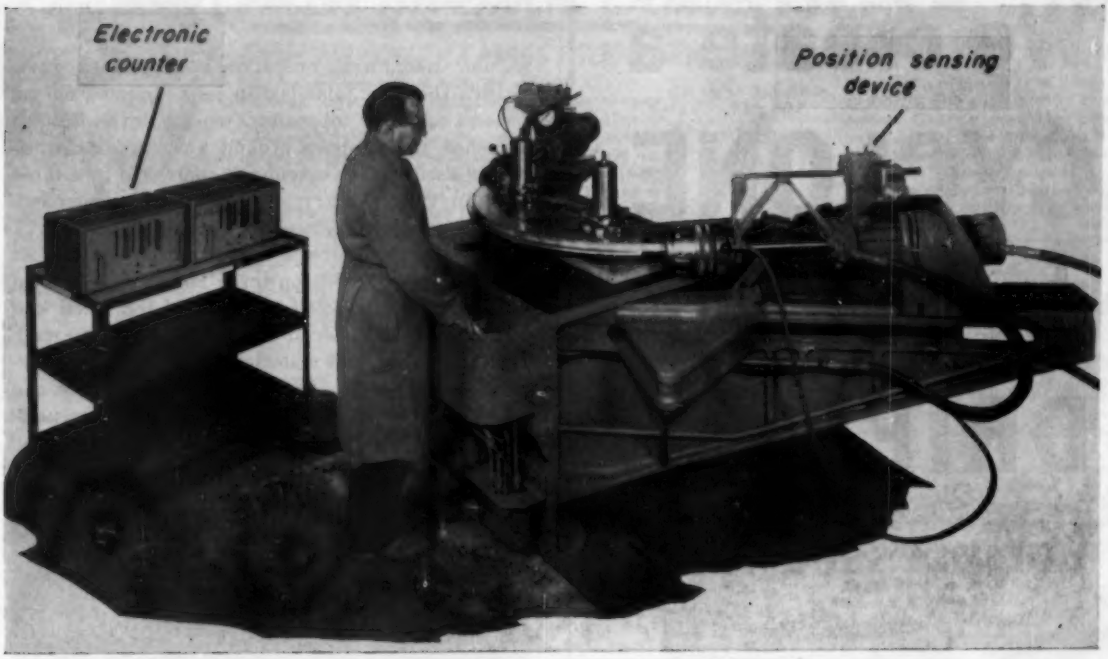
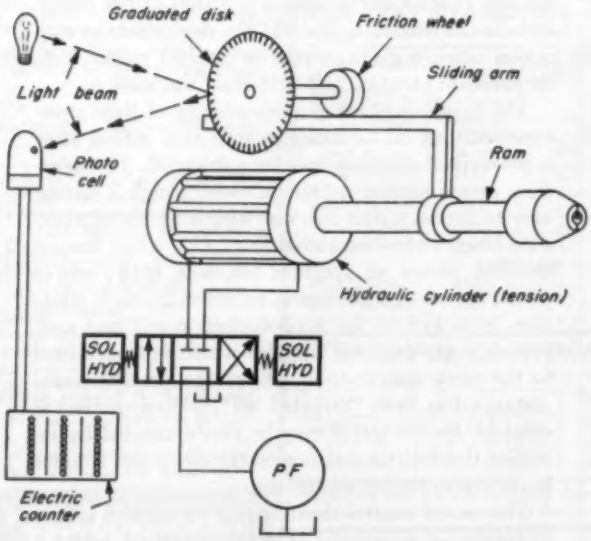


PISTON MOVEMENT is measured by a disc which is friction driven by the sliding arm on the piston. This measurement is transmitted by the photo cell to a counter which deenergizes a solenoid operating control valve to stop piston travel.

COUNTER ACTUATES SOLENOID VALVE

... to accurately control piston travel

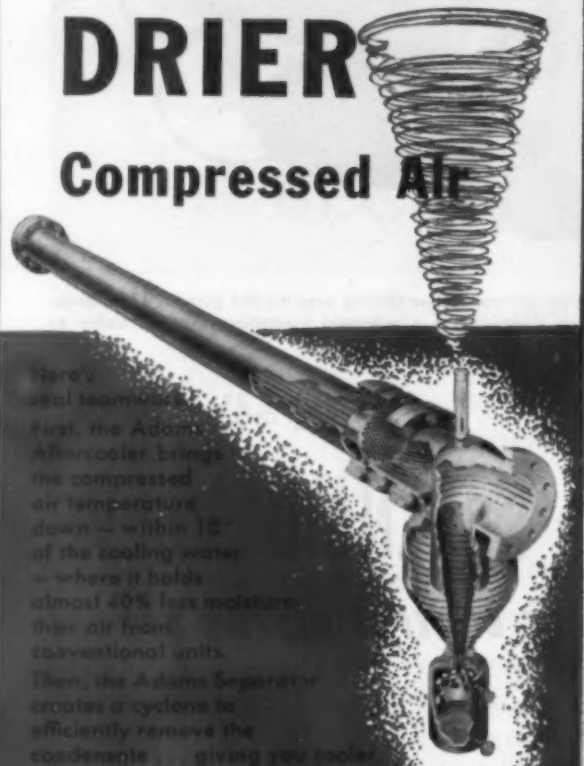


REQUIRED accuracy on stretch-wrap forming of metals is usually within 1/10th of an inch. While this doesn't appear to be a close tolerance when we think in terms of machining within thousandths or tenths of thousandths, it presents some difficulty when stretching a 10 ft long span.

To obtain a uniform amount of stretch regardless of varying hardness between workpieces, engineers at Hufford Machine Works developed an automatic "tension stop" control. This control consists of a photoelectric sensing device which sends pulses to an electronic counter. The counter acts as a relay in the electric control circuit of the hydraulic solenoid valve which directs oil flow to the stretching cylinder.

The machine includes a very clever combination of hydraulic, mechanical and electrical units. Power

We create a
CYCLONE
to give you
DRIER
Compressed Air



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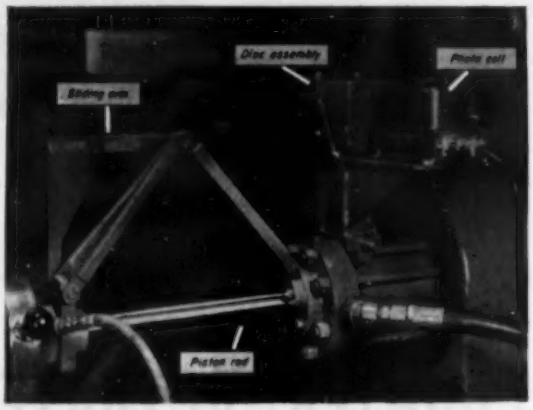
COUNTER ACTUATED CONTROL

for the stretch-wrap operation is supplied hydraulically. The work, clamped in jaws mounted on the piston rods of opposing tension cylinders is stretched and wrapped around a center die. Direction of each tension cylinder is controlled by a three position closed center, 4-way solenoid controlled-pilot operated valve.

The amount of stretch resulting from the pull of the cylinders depends on three factors: the applied pressure, the cross-sectional area of the metal and hardness of the material being stretch-wrap formed. Due to the fact that materials vary in hardness between mill runs, a different amount of stretch can result between two pieces pulled at the same pressure. Maximum stretch pressure is adjusted at the



PUNCHING the desired tension cylinder travel on the electronic counter keyboard automatically controls applied tension regardless of varying loads.

relief valve. Since it is extremely difficult to control the amount of stretch by adjusting pressure, the automatic control device senses position of the piston rods in the tension cylinders. The device acts to stop action when a given stretch is reached rather than let pressure exert its full stretch on the work.

The system operates independently of fluid pressure and can be adjusted to stop ram action after a prescribed distance has been traveled. In operation, piston motion is transmitted through a sliding arm to rotate a disk marked with a series of alternate black and white radial lines. One white line on the disk passes an aperture for each 1/10 inch of piston travel. A light beam, reflected by each white line, is picked up by a photoelectric cell and converted to an electrical impulse which is transmitted to the electronic counter. When the desired travel distance has been "counted off", piston motion is stopped. Piston travel may be readily varied by selecting the desired distance on the electronic counter keyboard in inches and tenths.

This novel control device could be applied to any hydraulic or pneumatic cylinder operating under a varying load. ▼▼▼

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PART NO.	BORE	STROKE	SHAFT	PSI	Type of CAP	THRUST	PRICE
PH34E	3"	4"	1-1/8"	1500	External Threaded	10,500 lbs.	$32.50
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PHE1	3"	8"	1-1/8"	1500	" "	"	37.50
PH312E	3"	12"	1-1/8"	1500	" "	"	42.50
PH34I	3"	4"	1-1/8"	1500	Inserted	"	32.50
PH38I	3"	8"	1-1/8"	1500	"	"	35.00
PH45E	4"	5"	1-1/8"	1500	External Threaded	18,750 lbs.	37.50
PH46E	4"	6"	1-1/8"	1500	" "	"	39.50
PH48E	4"	8"	1-1/8"	1500	" "	"	43.50
PH410E	4"	10"	1-1/8"	1500	" "	"	47.50
PH412E	4"	12"	1-1/8"	1500	" "	"	51.50
PH45E3	4"	5"	1-1/2"	3000	" "	37,500 lbs.	52.50
PH46E3	4"	6"	1-1/2"	3000	" "	"	54.50
PH48E3	4"	8"	1-1/2"	3000	" "	"	58.50
PH410E3	4"	10"	1-1/2"	3000	" "	"	62.50
PH412E3	4"	12"	1-1/2"	3000	" "	"	66.50
PH518I	5"	18"	2"	3000	Inserted	59,250 lbs.	85.00
PH524I	5"	24"	2"	3000	"	"	107.50
PH530I	5"	30"	2"	3000	"	"	130.00
PH636E	6"	36"	2"	3000	External Threaded	86,625 lbs.	265.00

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW-HEAVY DUTY HYDRAULIC CYLINDER

A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore. 13" stroke. 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds. . . **95.00**

GB-8-25 TON HYDRAULIC CYLINDER
Same as above except has 8" bore, 15" stroke. Will give 50000 lbs. thrust at 1000 PSI. Shipping weight 185 lbs. **105.00**

SAVE UP TO 85% ON GOV'T SURPLUS

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Thrust shaft is in two stages. First stage extends 39" – the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3¼" dia. Bore is 4¼". Ports are 1/2" AN pipe. **165.00**

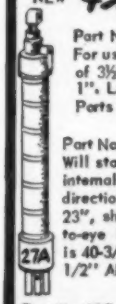
NEW 10 TON HYDRAULIC PRESS

Here is a rugged 10 TON Arbor Press you can use in the shop or take with you on the job. Has sturdy frame of 4" welded channel iron. Press has 4-1/4" stroke, 2-1/2" diameter ram. A control valve operates the piston in both directions. Platform is adjustable. Has positive power Hand Pump. 2000 PSI pressure gauge. NEW **129.00**

SPECIAL SURPLUS HYD. CYLINDERS

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.

NEW **43.95** USED **29.95**



Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29¾". Ports 3/8" AN pipe. **35.77**

Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Ports are 1/2" AN pipe. **45.00**

Part No. 27C – Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**

COST GOV'T APPROX. $6000 **$1495**

AIR ASSOCIATES HYDRAULIC TEST STAND

Electric motor driven type. Has a 2500 PSI Hydreco Pump which delivers up to 10 GPM. Powered by 15 HP, 3 phase motor using 220/440 volt, 60 cycle current. Unit has selector valves, pressure gauges, flow meter, reservoir, heat exchanger and filter pressure regulator. Mounted on steel frame. Has work bench, flourescent lights and hand operated, high pressure pump for testing to very high pressures. Overall size: 8ft. long x 7ft. high x 4ft. deep.

HYD. TEST STAND – Same as above but has a Reeves variable speed reducer to control the pump output as desired. **$1895**

NEW SURPLUS VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **44.50**

4" SPLINE SHAFTS for input and power take-off on above. $2.50 pair

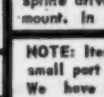
INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**

SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS

Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

Part No.	Cu. in. per rev.	GPM	PSI	RPM	PRICES NEW	PRICES USED
HYDRAULIC PUMPS						
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000	$29.75	$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
PF50-3915-30YG	1.520	19.7	3000	3000	—	200.00
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF9-713-30BCF	.600	9.75	1000	3750	$37.50	—
MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

PESCO HYD. PUMP



A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI – delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

HYD. HAND PUMP

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HOW TO REDUCE WEIGHT

of aircraft hydraulic systems

Part 2 By Component Design

Greatest weight savings can be made by proper design of the hydraulic cylinders. Materials and construction, damping devices, and means of limiting the load are described. Last month, Mr. Hancock told what could be done by circuit design to reduce weight.

• By K. G. Hancock

HAVING dealt with circuit design and its effect on the weight of pipes, hydraulic power packs and number of components, the question of reducing the weight of the components themselves which are used in the circuit arises. Weight can be saved on all components by paying great attention to detail design. Because of its comparative size, the hydraulic jack gives the greatest scope for weight reduction. Good jack design can also reduce the weight of attachment points in the airplane as the loads which the jack imposes on these members can be reduced by various means.

In a design office it is worth keeping a record so that the weight of past jack designs can be compared with those at present proposed and progress in this field noted. A convenient means of comparison is obtained by dividing the weight of the jack (lbs) by the total amount of work (inch-lb) it is capable of doing in one stroke, at its maximum working pressure. For comparison, jacks of similar dimensions should be used and for simple jacks having strokes of the order of 10 inches and cylinder bores in the region of 2.0 inches, a value of 0.6×10^{-4} is reasonable.

K. G. HANCOCK, *Chief Hydraulic Designer, Electro-Hydraulics Limited, Warrington, England.*

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Jack or attachment weight can be saved under the following headings:—

a) Choice of materials and construction.
b) Damping valves.
c) Load limiting means.

CHOICE OF MATERIALS AND CONSTRUCTION

Unlike most other structural members in the airplane, the hydraulic jack is stressed to its maximum working level during every flight when the pump reaches cut-out pressure, as most of the stresses in a jack are derived from hydraulic pressure. This requires that the fatigue life must be based on maximum working stresses and not on some other lower level.

In considering the use of light alloy it is necessary to decide the life required from the component, how many times it is "pressure pulsed" during this life, and with this information, appropriately factored, determine the stress level to be used in the design of the jack so that this life will be achieved.

Figure 6 shows, for a hypothetical naval fighter, the number of times the components in the various circuits are pressure pulsed during one typical flight, the column on the left indicating the services used at the start of flight when the machine is brought up the lift on the carrier, until it is taken down again on completion of the flight. If the average flight duration is 1 hour, and the total life required 1,000 hours, the number of pulses during the life of any component is evident. It is interesting to note the reduction in pulses due to the incorporation of non-return (check) valves, isolating the various circuits from each other.

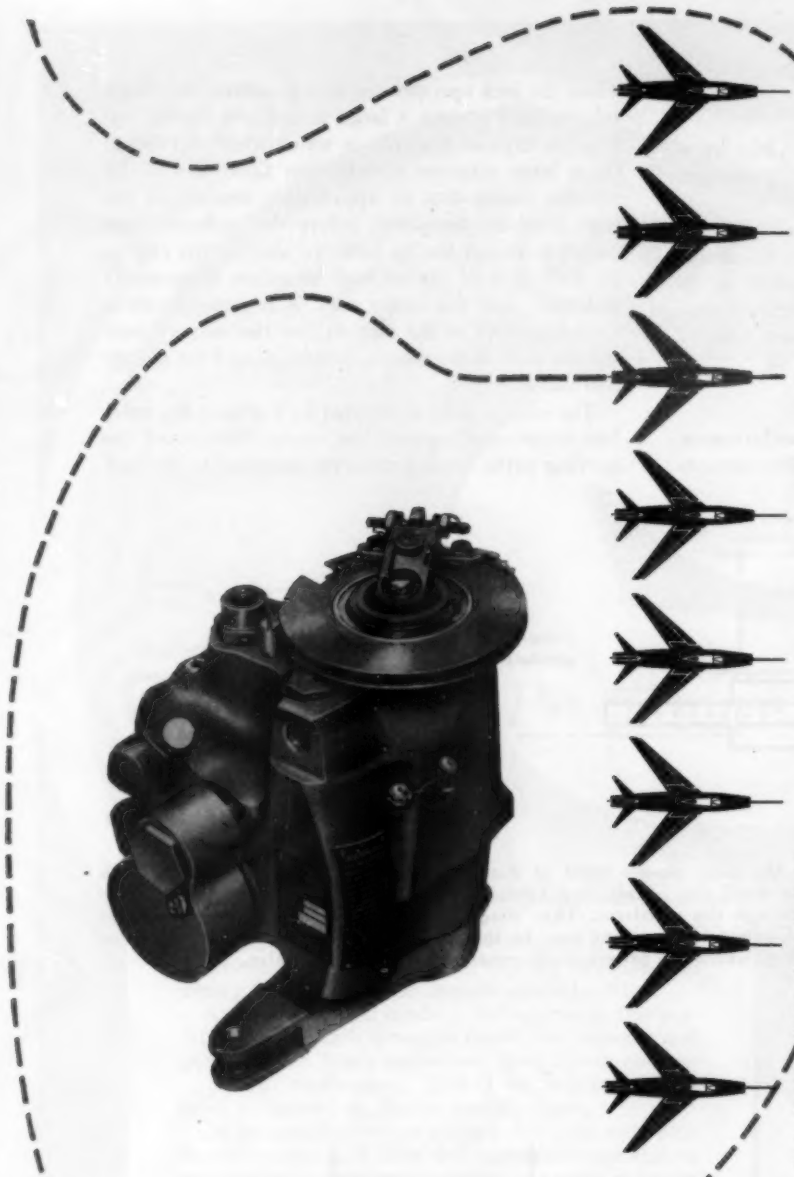
The choice of allowable stresses then to be adopted is based on the S/N curve which has been established for jacks in the material. There is little published data on the S/N curves of the light alloys used in aircraft engineering, and most of the knowledge available is obtained from the extensive fatigue testing which most of the users of light alloy are now undertaking.

When steels are used, normal practice is to use materials having an ultimate tensile strength of 80 tons/in^2 or more, and hydraulic seals are designed to function satisfactorily under the conditions of piston and cylinder clearance which occur at the working pressure when steels having high ultimate tensile strength are used.

With any highly stressed part, irrespective of the material, fatigue tests are necessary, and must be carried out on components which are representative both of design and manufacture. It is useless, for

		System modified to include non return valves to isolate circuits															
		Number of times pressure falls more than 1500 p.s.i.								Number of times pressure falls more than 1500 p.s.i.							
	Services which may be selected	System	U/C jacks	Air brake jacks	Wing fold jacks	Nose flap jacks	Hook jacks	Trailing flap jacks	Fuselage flap jacks	System	U/C jacks	Air brake jacks	Wing fold jacks	Nose flap jacks	Hook jacks	Trailing flap jacks	Fuselage flap jacks
Ground	Engine start	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wings spread	2	2	0	4	2	2	2	0	2	0	0	4	0	0	0	0
	Air brakes out	2	2	2	2	2	2	2	0	2	0	2	0	0	0	0	0
	Air brakes in	2	2	2	2	2	2	2	0	2	0	2	0	0	0	0	0
	Flaps up	4	4	0	4	4	4	4	4	4	0	0	0	1	0	1	4
	Flaps up	4	4	0	4	4	4	4	4	4	0	0	0	1	0	1	4
	Flaps take off	1	1	0	1	1	1	1	1	1	0	0	0	1	0	1	1
	Flying control ch'k	3	3	0	3	3	3	3	0	3	0	0	0	0	0	0	0
	U/C up	3	3	0	3	3	3	3	0	3	3	0	0	0	0	0	0
	Flaps up	1	1	0	1	2	1	2	2	1	0	0	0	1	0	1	1
	Air brake out (6 ops.)	10	10	10	10	10	10	10	0	10	0	10	0	0	0	0	0
Flight	Air brake in (6 ops.)																
	Flaps down	1	1	0	1	1	1	1	1	1	0	0	0	1	0	1	1
	U/C down	3	3	0	3	3	3	3	0	3	3	0	0	0	0	0	0
	Hook down	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Hook up	1	1	0	1	1	0	1	0	1	0	0	0	0	1	0	0
Ground	Flaps up	1	1	0	1	1	1	1	0	1	0	0	0	1	0	1	1
	Wing fold	2	2	0	2	2	2	2	0	2	0	0	2	0	0	0	0
	Stop engine	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1
	TOTAL	41	41	15	43	42	41	42	13	41	6	15	6	6	1	6	13

FIG. 6. This analysis assists in estimating fatigue stresses. Chart shows the pressure pulses which components on a hypothetical 4,000 psi fighter system would have to withstand during each flight. If each flight averages an hour, and components must have a life of 1,000 hours, the amount of pulses can be determined.



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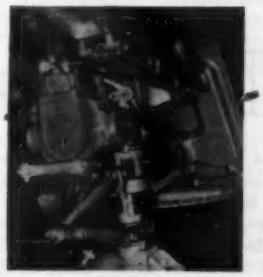

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example, to attempt to clear production jacks by a fatigue test on components made by prototype methods.

With either light alloy or steel, weight can be saved if the simplest possible construction consistent with good reliability and ease of servicing is achieved. Once having determined the lightest construction, it is sound policy not to depart from it unless there are good reasons for doing so.

DAMPING VALVES

The modern airplane demands high performance from the hydraulic system. Some of the services which the jack operates, move at comparatively high velocity and possess a large amount of kinetic energy. A typical example is undercarriage raising. On a large airplane a retraction time of 7 to 10 seconds means that an appreciable amount of energy must be dissipated before the undercarriage comes to rest at the up lock. To absorb this energy by deflection of the up lock structure is generally unsound, and the better way is to incorporate a damping valve in the jack so that the velocity over the last part of the raising is reduced and the energy dissipated.

The energy to be dissipated by the damping valve has three components; the kinetic energy of the moving parts, the input energy supplied to the jack

DAMPING DEVICES

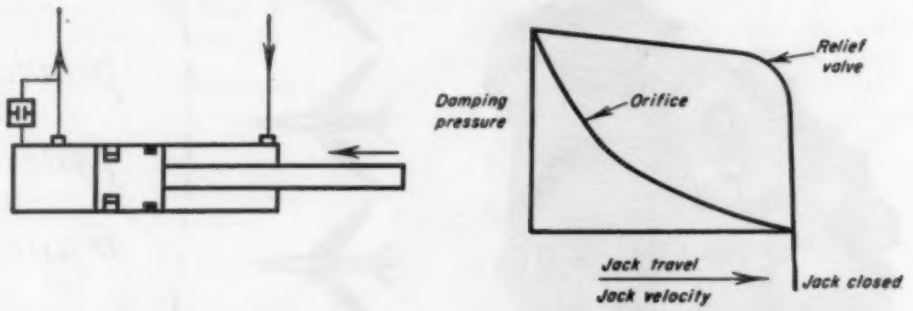

FIG. 7. Probably the most simple form of damping. Outlet oil passes from the jack without restriction until the piston ring (metal) passes the outlet port and compels the oil to pass through the restrictor. The "diagram factor" indicating the amount of energy actually absorbed is poor, but may be increased by replacing the one restrictor by a series of orifices which are progressively covered, or by a relief valve.

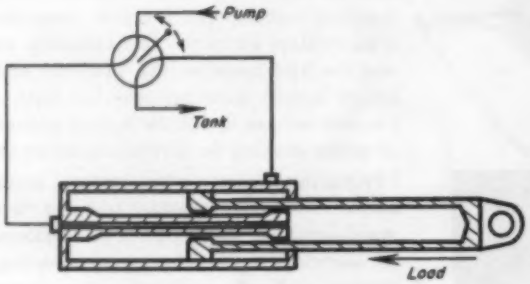

FIG. 8. Another simple damper, generally used when the external load is unidirectional. Return oil, on jack closing, is restricted at the end of travel by the piston moving along the tapered central rod, using the full area for damping purposes, and thus avoiding the necessity of restricting the input. On full jack extension the input oil is restricted and friction and the external load (which is now opposing the jack movement) are used to bring the moving parts to rest.

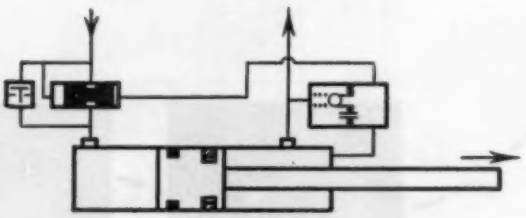

FIG. 9. This shows a more elaborate damper and is used when damping is required during jack extension with a following load. As the area on which damping pressure acts is smaller than the input area, the input oil must be obstructed if excessive pressures are not to be produced on the annular area. As in the first example, the outlet oil passes freely from the jack until the port is covered by the metallic seal on the piston. At this point the pressure rises and energy is dissipated through the relief valve. This pressure acts on a valve mounted at the inlet to the jack, and cuts-off the supply when the pressure in the damping chamber is higher than the supply pressure. The final velocity with which the jack reaches the end stop is determined by a restrictor in the damping chamber arranged to by-pass the relief valve, the input rate of oil being automatically controlled by the input valve to the appropriate value to suit the jack velocity. A non-return, (check) valve is arranged so that jack closure can be obtained in the normal way by supplying pressure to the annular area.

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by the hydraulic system while the parts are brought to rest, and, when moving with a following load, the work done by the external load during this time. In simple cases the energy can be absorbed by partially obstructing the supply of hydraulic power to the jack, and allowing the friction of the jack and the external load to bring the moving parts to rest. In other cases, notably when moving with a following load, it is necessary to absorb energy by an orifice or relief valve at the jack outlet, and in some cases to arrange for the input oil to be partially obstructed as well.

Figures 7, 8 and 9 show various forms of damping valves.

LOAD LIMITING MEANS

If a jack which stops on external (not internal) stops is required to close against a large tension load, and extend against a smaller compression load, the size of the jack should be governed by the annular area which is required to produce the tension load when supplied with oil at the working pressure. The jack attachments in the aircraft, and the jack itself, however, need to be stressed to cut-out pressure, with appropriate strength factors, acting on the full area. This condition can produce an overriding design case giving a minimum size of piston rod which is capable of withstanding the strut load

. . . giving attention to design details of components results in considerable savings in weight . . . cylinder design offers the greatest opportunity for weight reduction . . .

and, in effect, the jack is designed on the resulting compression load instead of the major original tension load.

This case can be mitigated if the full area of the jack is supplied at reduced pressure, which is usually troublesome, or alternatively if a load limiting feature is used so that the compression load which the jack can exert is limited to a value sufficient to overcome the external operating compression load. The simplest arrangement is probably that shown diagrammatically in Figure 10. In this arrangement the piston has a limited amount of freedom on the rod and the jack is arranged so that just before full extension the piston stops on the cylinder end fitting, and movement to the fully extended position is obtained by pressure acting on a reduced area. During jack closure, the whole of the annular area is available for moving the external tension load.

There are various forms of load limiting devices most of them being similar in principle, and, dependent on the construction adopted, any degree of load limitation can be achieved.

One feature must, however, be kept in mind. In all arrangements there is usually a small amount of lost motion, so that it is possible under certain circumstances for the piston rod to move a small amount without expelling oil from the jack. If the jack shown in Figure 10 is locked in the closed position by a separate mechanical lock, operated by a second jack, the piston in Figure 10 will move towards the annular side of the jack while the lock is being released if pressure is applied simultaneously to the two jacks to unlock and extend. When the lock is released any tension load will cause the jack to extend without displacing oil until the piston returns to its other stop, and hence a restrictor at the outlet to control the speed of extension will be ineffective during this lost motion.

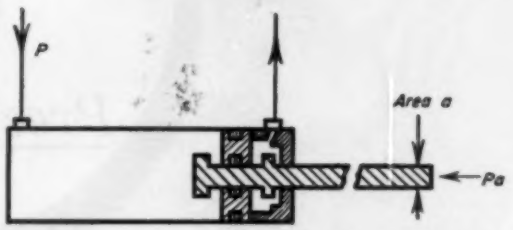


FIG. 10. This design reduces the compression stress on the piston rod. The piston has a limited amount of freedom on the rod. The piston stops against the cylinder before the completion of the extending stroke. Movement to the fully extended position is obtained by pressure acting on a reduced area.

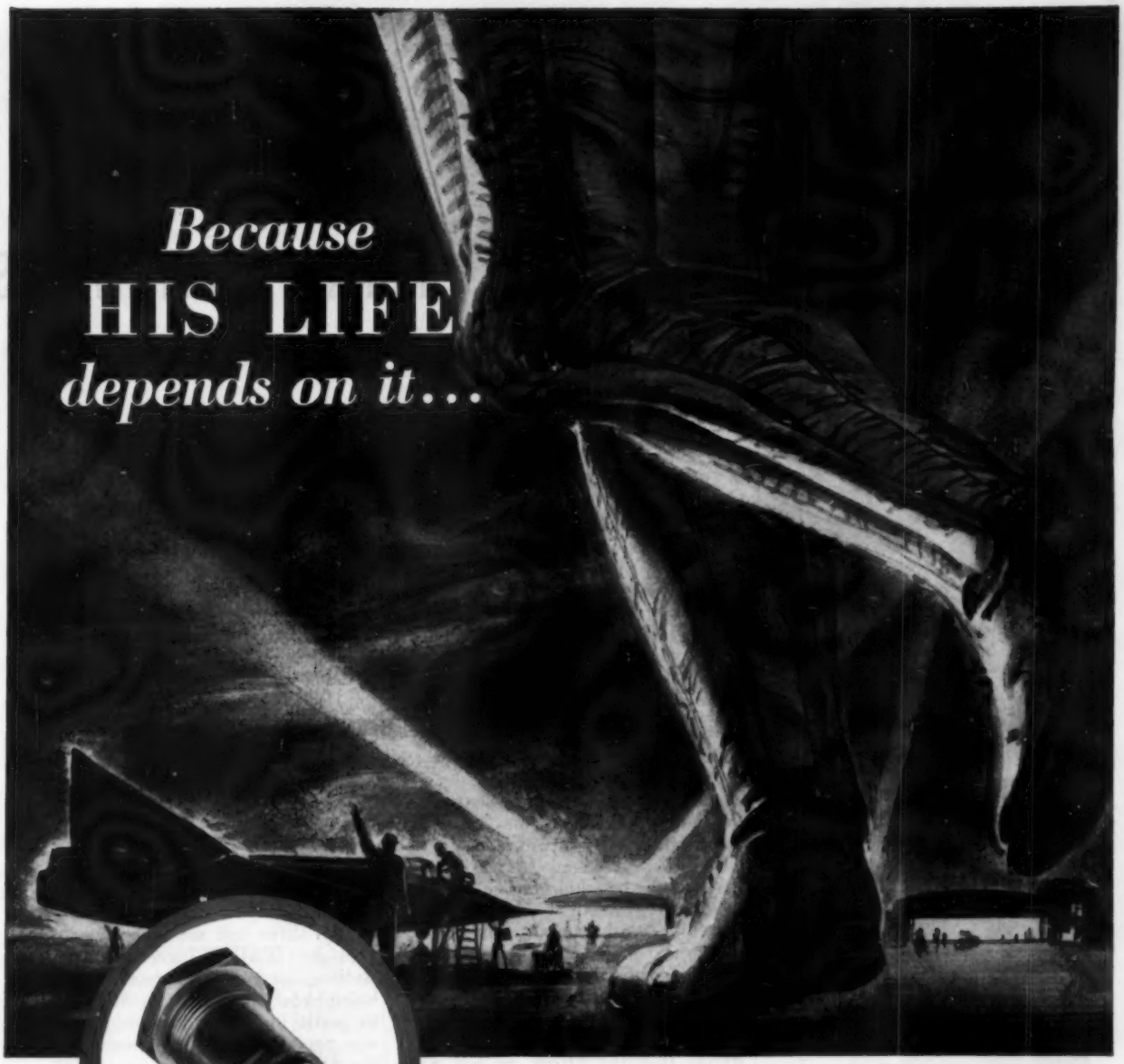
The free fall so occurring may give rise to excessive pressure surges, but if this point is appreciated during the design, steps can usually be taken to deal with this aspect.

CONCLUSION

There is much to be gained by a comprehensive review of various types of hydraulic systems, from the point of weight saving during the project stage of a new airplane. The amount of investigation which can be carried out before a final decision has to be made is necessarily limited, but generally a good indication can be obtained as to which type of circuit is likely to prove the lightest. If, as is generally the case in Great Britain, this preliminary work is undertaken competitively by two or more specialist firms, the aircraft manufacturer is in a position to compare the weights of a number of different circuits. This information is of value to him when making his final decision.

▼▼▼

The author is indebted to Electro-Hydraulics Limited for permission to publish much of the information contained in this article. Many of the circuits and features described are the subject of Letters Patent or Patent Applications in the United States, the United Kingdom and other countries.



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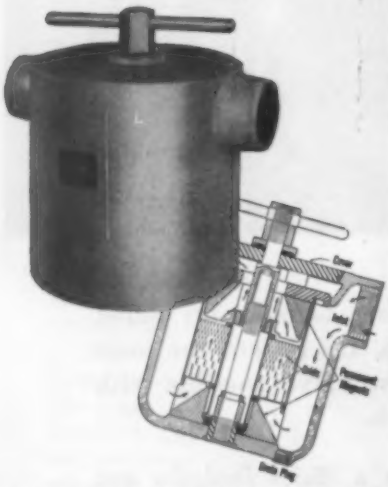

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SAE AIRCRAFT COMMITTEES

SAE Committee A-3, Aircraft Fittings and Flexible Hose Assemblies, held their regular semi-annual meeting on Monday, April 25 at the Sheraton-Mt. Royal Hotel, Montreal, Canada with 95 representatives of the airframe, airline, supplier and the Services. Chairman L. J. Henderson, retiring from the Committee after 14 years, turned the meeting over to R. W. Phillips as temporary chairman.

Fittings: Variation in customer quality control requirements have caused a good deal of difficulty. There seems to be no agreement as to what constitutes a "nick" or a "dent" or how to measure the included 37 degree angle. At the suggestion of the chairman, a subcommittee will attempt to resolve definitions and resubmit this item at the next meeting.

The North American, (Columbus) representative brought up a conflicting pair of specifications: MS-F-18280 (flareless fitting) requires that the fitting be left a light yellow, while MIL-F-5509 requires that the fitting be green. The Committee determined that the MS spec be followed.

The Lockheed member reported that a dry film lubricant, developed for oxygen fittings, has shown a great deal of promise. It was determined to request the NASC to survey the industry. A uniform test method also must be developed for this lubricant.

Hose: Reports on the "Spiral Wrap" hose were made by both the Aeroquip and the Anchor Coupling members. While good results were reported so far on sizes -6, -8, -10 and -12, it was evident that special equipment was necessary to put the layers on consistently and smoothly. Difficulties were reported with the use of natural rubber for bonding. In the oil immersion test, synthetic hose came apart quickly. The concensus of opinion was that the oil immersion test probably was not required. Both WADC and BuAer requested samples for their own testing.

The sub-Committee chairmanned by the Aeroquip member reported on two proposed specs: "Hose for Use in Fuel and Oil Systems" and "Light Weight Hose for Use in Airframe Fuel and Oil Systems". Because the specs concerned aircraft fuel and oil systems, Committee A-16 has surveyed the industry and no action was taken by A-3.

MIL-H-5512: The Weatherhead member reported that comparative tests on AN 6292-10 hose assemblies had given unrelated answers on the three test machines operated by WADC, United States Rubber and Weatherhead. An amendment, proposed by WADC to assist in the testing program, was promised quick clearance by the ASG representative.

The United States Rubber representative reported on efforts being made to standardize on impulse testing and an impulse machine. There was no agreement due to the large number of variables in the hose itself even if the machines were closely calibrated. BuAer has still to study and comment on the hose, hose assembly and hose end specifications.

MIL-H-5511: The ASG representative reported that the final draft of both the hose and hose assembly specs were sent to the industry in April, to AIA on May 1 and that the publication date would be approximately June 1.

The ASG representative reported that changes in spec MIL-F-5070 were acceptable to WADC, except the torque requirements on hose fittings. No BuAer comment had been received but a reading

Recent meetings of the SAE A-3 and A-6C are reviewed. Last month SAE A-6 was reported

and agreement is hoped for shortly after June 1.

Sealing Surfaces: The Stratoflex representative distributed a written report of the comments received from an industry survey on "Line Seal" sealing surfaces. Recent tests were run only by Aeroquip and Stratoflex but a summary of the earlier Chance Vought Leak Committee report was also included. Little difficulty was reported.

Flame Test: A progress report was made by the chairman of the Flame Test Sub-committee in which all components were in the fire area. No action was taken on a recommendation for a fire test paragraph for use in both MIL-H-5511 and MIL-H-5512.

AND 10050: The WADC representative reported that tests with metal seals had been completed and that a report would be ready in a few days. The ASG representative reported that changes had been made in AND sheets 2 and 3 which call for MIL-L-4343 grease in pneumatic systems.

WHEN J. A. Mileti called the SAE Subcommittee A-6C, Hydraulic Pumps, Motors and Air Compressors, to order on Tuesday morning, April 26, at the Sheraton-Mt. Royal Hotel, Montreal, Canada, over 100 representatives of airframe and airline, engine and pump suppliers were on hand. Major discussions were based on specifications for the variable delivery, power driven hydraulic pump, the constant displacement aircraft hydraulic motor and the proposed changes in four high speed pump specs.

MIL-P-7407B, Pump, Hydraulic, Power Driven, Variable Delivery: BuAer was not ready to report on

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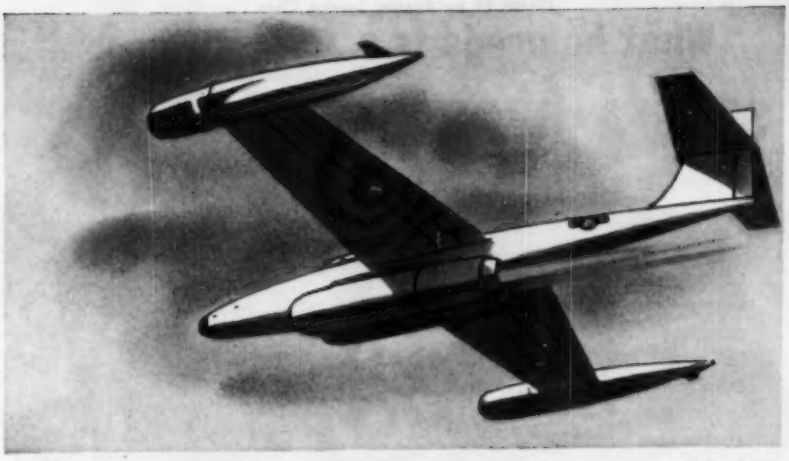

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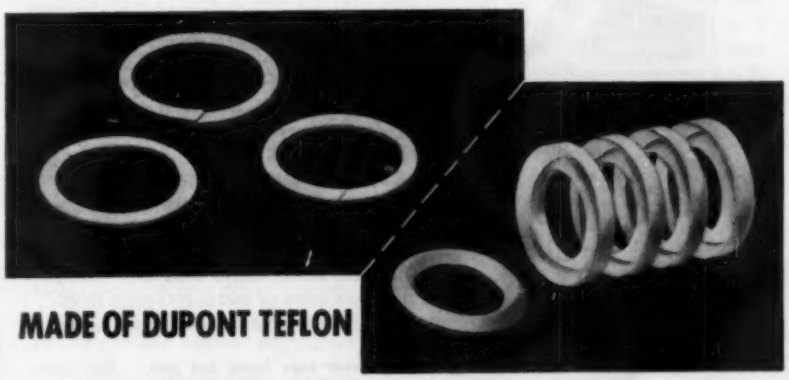

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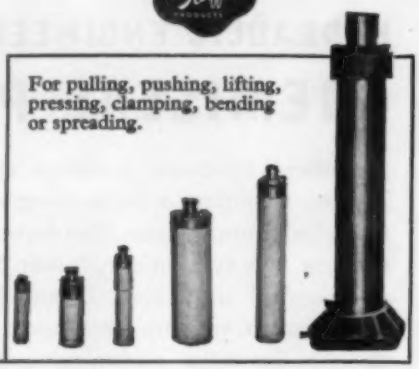

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the issuance of this spec. The Vickers member pointed out the impracticality of the requirement that transient pressure be checked with one size cylinder for all sizes of pumps. He suggested that the cylinder vary in capacity with the rated delivery of the pump. The Lockheed member recommended that the proof pressure be changed from 135 percent to 150 percent of the rated pressure. This was accepted by the Committee. The same member circulated a proposal for endurance testing of variable delivery pumps in which a number of changes (inlet temperatures, pump inlet pressures etc.) were suggested.

The chairman requested that the New York Air Brake member rewrite the spec and report back to the meeting.

MIL-M-7997; Constant Displacement Aircraft Hydraulic Motors: With the goal of reviewing ratings of motors, the Lockheed member presented a chart of suggested changes. There was considerable discussion. The chairman asked the Vickers and the Lockheed members to get together and attempt to settle the differences and report at the next meeting, suggesting that the spec be modified on the basis of units which are actually being bought.

The Lockheed member also suggested an additional test to measure the actual starting torque required to start a given load in addition to the stalled torque, now specified. The same member also requested that the endurance test of the motor specification be modified to more accurately simulate motor operation in an actual aircraft installation.

MIL-P-7740, 7858, 5954 and 5994A, Hydraulic Pump Specifications: The New York Air Brake member suggested that changes made in the high speed specs be carried over into other new pump specs. SAE is coordinating with ASG on the proposed revisions.

A number of other items were also discussed, recommendations made and Committee assignments distributed. The Hamilton Standard representative in reporting on the general specification for Power Driven Variable Delivery Hydraulic Pumps recommended that this spec requires substantial completion before the 5000 psi and high

temperature detailed specs could be worked on. Since this general spec would cover all Power Driven Variable Delivery Pumps, including the Proposed High Speed Spec as well as the Proposed 5000 psi High Temperature Spec and the Proposed High Temperature Spec, the Chairman asked the Hamilton Standard representative to head a Sub-committee with representatives of New York Air Brake, Denison Engineering, Vickers and Pesco to expedite the work on the General Spec.

SAE Aeronautical Recommended Practice for Pilotless Aircraft Hydraulic Pumps and Motors: The North American representative reported that the returns from his survey to missile pump manufacturers and builders were incomplete as yet. The Chairman asked him to complete the survey and to report at the next meeting.

AND 20000 Series Standard Drives: The Pratt & Whitney member reported that the spec on standard accessory drives, being prepared by the Accessory Drive Panel of Committee AE-1 was about ready and would be available at the SAE New York meeting in July.

Proposed High Temperature Hydraulic Pump Specification: The Sundstrand Aviation Division member submitted a written report of a survey to airframe and aircraft engine engineers. The answers indicated that the industry definitely wants to standardize at definite levels of inlet temperature; that such desired temperatures are 275, 400 and 550 degrees; that the hydraulic fluid picture at temperatures above 275 degrees is confused and not satisfactory; and that reduced pump life at temperatures above 275 degrees would be acceptable. Most also agreed that temperature cycling should be a necessary test procedure.

The Services want such a spec; the WADC representative stated that the 275 degree spec is needed now and that the target date for the 400 degree spec would be two years.

Air Compressor Specifications, MIL-C-6388A, 8215, 8216 and 6591A: No action has been taken by the Services since the report of the Cornelius representative at the last meeting. The Committee is keeping the job and an assignment will be made to continue the work.

▼▼▼

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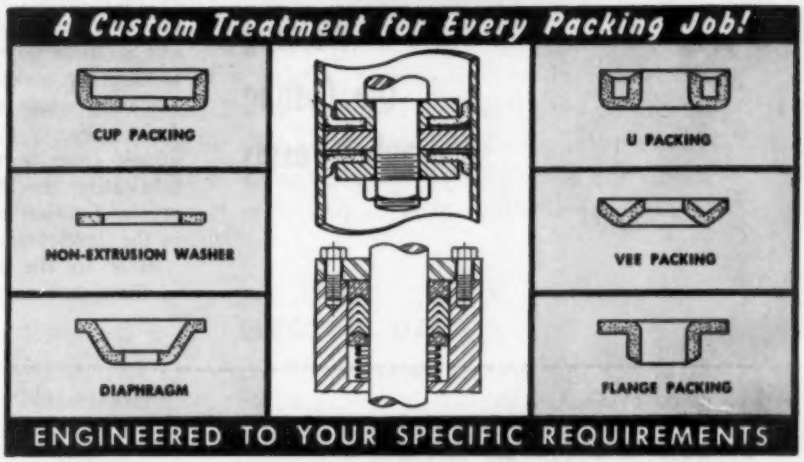

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FABRICATING MACHINERY HYDRAULICS

Plastic Molding
Welding
Die Casting
Hydraulic Presses

IDEAS which will improve hydraulic system and product design and simplify maintenance were exchanged at the Fabricating Machinery Hydraulics Conference in Detroit, May 17 and 18. About 100 men, representing builders and users of presses, welders, die casting and plastic molding machines, met with engineers from the sponsoring company, Vickers Incorporated, and suppliers of accessories including packings, fittings, hose, tubing and hydraulic fluids.

Co-moderators for the two day meeting were R. E. Russell, master mechanic of Chrysler's 9 Mile Press Plant and A. J. de Matteo, chief engineer, Watson-Stillman Company Division of H. K. Porter Company.

Discussion of questions, which were submitted by participants, indicate that users are primarily interested in techniques which will reduce leakage and machine downtime. The machine builders are looking for easier assembly methods, and circuits and components which will minimize shock in their designs. Safety to machinery and personnel is of utmost concern to both the builder and user of fabricating machinery. Die casting and welding present ignition sources which cause great interest in the development and use of fire-resistant fluids.

Here are the highlights of discussion on many of the questions presented at the conference.

CIRCUIT AND SYSTEM PROBLEMS

Compare regenerative or differential circuits with prefill circuits on fast moving machines.

The differential circuit can give equal speeds in both directions with a smaller pump than required on a conventional circuit. Care should be taken to provide large enough pipe sizes to handle the flows. The prefill circuit is generally used on larger machines having long strokes and requiring very large oil volumes.

One machine builder indicated that extreme shock resulted from the use of a differential circuit on a long stroke power metal press.

On hydraulic presses which is preferred—a closed circuit with reversing pump or unidirectional pump with external control valve?

In comparing these two circuits, A. L. Duncan, Williams-White and Co., gave preference to the unidirectional pump circuit for general production presses because of its greater adaptability. Use of a 4-way valve provides a neutral position for holding the press. Either pump can be controlled manually, hydraulically or electrically. Use of the reversing pump permits circuit design with less piping and fewer leakage points. E. S. Keyser, Lake Erie Engineering Corp., voiced preference for the reversing pump because of the reduction of shock. There appeared to be general agreement, however, that the reversing pump is not too good for short stroke presses because additional valving for decompression is needed. Supporting this opinion, W. A. Fletcher, Delco Remy, told about a ¼ inch stroke coining press.

On compression and transfer molding presses what are the advantages of pressure compensated pumps?

F. Arpajian, F. J. Stokes, favored the use of pressure compensated pumps over a fixed displacement pump and accumulator to maintain pressure during the holding portion of the cycle. Using the pressure compensated pump, no unloading system is needed. The pump has reserve for leakage and slippage and produces less heat.

What are users preferences about pressures?

The user of fabricating machines is more familiar with pressures over 2000 psi than is the machine tool user. Although problems of leakage and shock increase with pressure, the builder and user of heavy machines are solving these problems. Everyone seems to agree, that little is to be gained by using a pressure greater than demanded by the load and space limitations. But where pressures even over 5000 psi have been required, successful designs have been worked out. Mr. Ehlers said that there is room for both high and low pressure on some machines. If some designs were based on pressures below 1000 psi, components would be of a size which is not easily obtained. Leakage on high pressure machines is being reduced by using welded flange fittings with "O" ring seals.

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FABRICATING MACHINERY

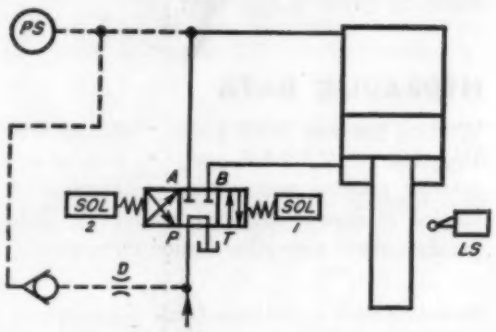
Continued

"We are not afraid to design for high pressures," was the comment of Mr. de Matteo. Process machines using water at 100,000 psi have been built. Low pressure on large equipment is not practical. Leakage on extruders and injection molders operating at 3000 psi is licked by using 6000 psi double strength piping with forged steel flanges.

Can decompression of high pressure oil be controlled without sacrificing cycle time?

This is one of those "you can't have your cake etc." situations. Decompression must take time and should be allowed for in the design of large presses. W. Ehlers of Baldwin-Lima-Hamilton said decompression techniques varied with the size of the press ram, the type of pump and operating pressures. Where a unidirectional pump is used, decompression requires a control for the reversal of the 4-way valve to raise the ram. To avoid shock, energy in the compressed oil at the top of the ram must be released before the valve is reversed.

One technique for supplying dwell before valve reversal is to use a pressure switch. This simple



circuit is one of many that can be used. A dual type pressure switch is used. At the high setting, solenoid 1 is deenergized to cause the 4-way to be spring centered. Oil under compression bleeds to tank through orifice D. The size of D determines the time of decompression since solenoid 2 is not energized to reverse the 4-way until pressure on the blank end of the cylinder drops to the low setting of the pressure switch.

Frank Mackin, General Motors Institute, suggested that the use of an unloading valve in the line to the blank end would keep the shock wave from hitting the entire circuit. Lou Zimmerman, Clearing Machine Corp., told about their circuit which uses an air actuated relief valve in the decompression circuit.

On small presses, tapering the lands of the valve spools is often sufficient to provide decompression.

What are the benefits of accumulators on welders?

Action from an accumulator is fast. Flow rates to 100 gpm are obtained. With an accumulator, a smaller pump may be used. Once the accumulator is charged, the pump is unloaded. This action generally reduces power costs.

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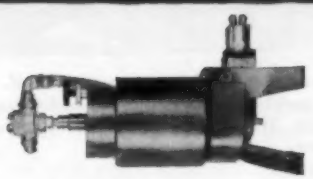
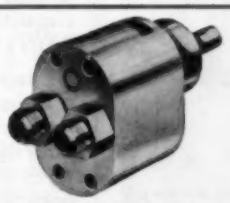


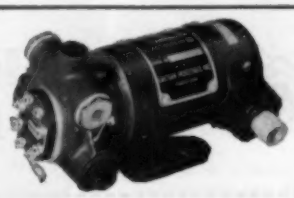
Close up of a phase detector with Eastern Fluid Motor atop it. The fluid motor supplies instant power to move the printing cylinder and correct off-registration within a tolerance of .0025".

Rear view of 8-color, 36" rotogravure press showing individual Registron control units cable-connected to their respective phase detectors. A second cable carries impulses to the units from each web scanner.

HYDRAULIC PUMPS



FLUID MOTORS



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FABRICATING MACHINERY

Continued

W. Greenwood, Ford Motor Company, said they experienced difficulty in maintaining pressure with hydropneumatic accumulators on welders. Maintenance has been high.

Use of piston intensifier type tandem cylinders was discussed by Bill Adamek, Fisher Body. Units having 4:1 and 5:1 ratio are powered by shop air. A large size minimizes pressure drop.

At A. O. Smith Corp, E. T. Anthofer said large accumulators, 36 inches in diameter and 40 feet high, use air or nitrogen in direct contact with the water. Operating on a 10% pressure drop there is very little maintenance.

Conference co-moderators were R. E. Russel, left, master mechanic, Chrysler's 9 Mile Press Plant, and A. J. de Matteo, chief engineer, Watson-Stillman Company.

Why can water hydraulics use flow velocities up to 50 fps while maximum practical oil velocity is 20 fps?

Flow velocity is limited to minimize pressure drop and resultant power losses and heat. Since water has lower frictional properties than oil, water can be moved at higher speeds.

Would any standards used on aircraft hydraulic circuits benefit the fabricating machinery industry?

Since service life requirements between industrial machines and airplanes are so different, most aircraft standards wouldn't help. However, three design features on aircraft were pointed out as valuable to all types of hydraulic equipment: 1. supporting of pipe lines approximately every two feet with micarta blocks; 2. abolishing pipe threads; 3. filter specification MIL F 5504-A.

Are J.I.C. standards being applied to fabricating machines.

It seems that most purchasers of injection molding machines and die casting machines don't know what J.I.C. is. Because the automotive industry, which is strong in its demands for adherence to J.I.C. standards, is a large purchaser of die casting equipment, many builders will be forced to comply. There will

have to be some deviations. For example, floor space will limit the possibility of power units separated from the machine base.

When a hydraulic system is under pressure, how can a pressure drop be avoided when other solenoid valves are energized?

Three methods were suggested: 1. accumulator to hold pressure; 2. check valve in pressure line to trap pressure; 3. occasionally a separate pressure source is needed.

What improvements are needed for drives on press feeders?

Users of hydraulic press feeds say that the main problem is holding a proper feed rate at all time. Temperature variation upsets operation. Particularly when starting up a cold system in the morning. Long lines and compression effects are causing feed variation. C. M. Wiig, F. J. Littell Machine Co., said that feed control is an overall circuit problem which is being solved by thermostatic controls, proper filters, leakage control and the elimination of pressure adjustments.

How to cut down surges in die cast machines.

Users are concerned about the surge which results when the die opens on the ram return. Some correction is obtained by use of an accumulator with a ¼ inch orifice between the accumulator and the return line. Use of oversize lines appears to be a step in the right direction.

One user attributed much of this surge problem to the fit between pins and bushings on the ram toggle mechanism. Perhaps this surge can be eliminated by mechanical rather than hydraulic considerations.

Is there a trend toward replacing hydraulically powered motions with mechanical power?

Discussion on this point centered around speed. Some users of high speed welders, cycling at over 30 strokes a minute, believed that these speeds are difficult to get hydraulically. However, users of high speed mechanical drives are having headaches with clutch wear. There appeared to be agreement that the use of a hydro-mechanical system where locking is done mechanically works very well.

PUMP AND VALVE DESIGN

Is there a need for a deceleration valve with a 1 inch stroke to provide better control than present short stroke designs?

It was pointed out by Al Lane of Vickers that increasing the stroke could present a mounting problem. Also stroke length is not the only factor which determines performance. Taper length on the spool and design of the operating cam are important. Also the use of a notched spool will alter performance. Bill Srutske, Kimble Glass, asked, "What happens when the cam isn't accessible for adjutsment?" He felt that a longer stroke and adjustment would give better results.

With a pressure compensated flow control valve what's the effect of viscosity on cylinder speed?

Provided leakage remains the same, reduced oil viscosity will cause an increased feed rate. Tempera-

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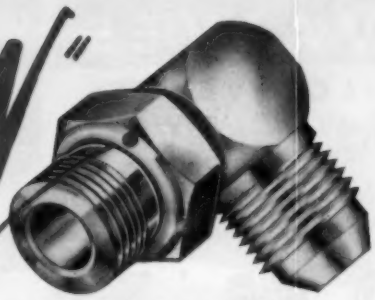

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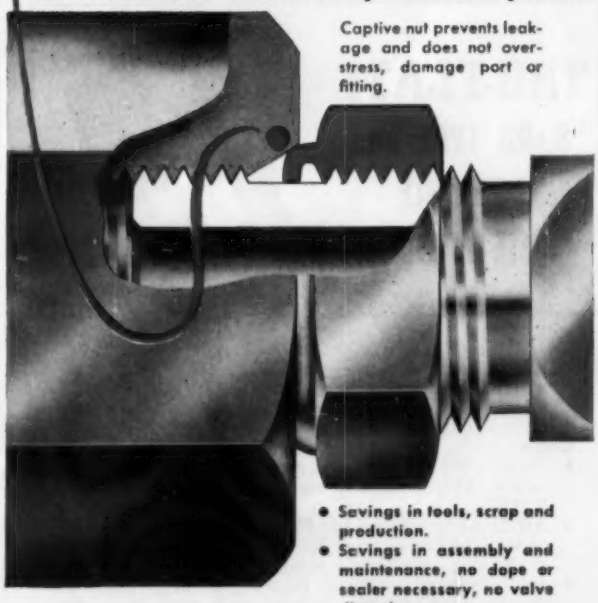

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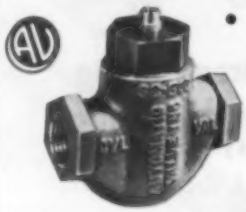

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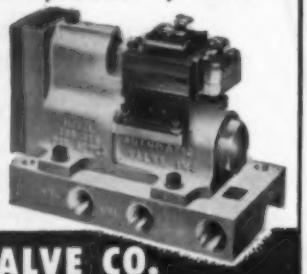

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FABRICATING MACHINERY

Continued

ture regulation will help eliminate variation. Development of a flow control valve which will compensate for temperature variations is underway.

Engineers would like to know the time it takes for a valve spool to shift.

On some jobs valve operating time is a large proportion of total cycle time. Discussion indicated that data on spool shift time for direct solenoid operated and solenoid controlled-pilot operated valves is available. However, where pilot pressure is used, time varies considerably with pressure. Oil viscosity also has an effect.

Information about minimum areas through valving or pressure drops at various velocities is desired by designers.

Some of this information is available when using an oil at a specific viscosity and temperature. Most valves are designed to give nominal pressure drop of 20 to 50 psi. It was pointed out that this nominal drop could cause difficulties when several valves are used in the circuit. The valve manufacturer has the obvious problem of producing a valve with minimum pressure drop in the optimum size envelope.

"Application of fabricating machines is expanding . . . it is more economical to displace metal than remove metal. . . . There is need for: feed controls unaffected by viscosity changes—low cost fire-resistant fluids—means for reducing leakage—improved controls for limiting tool loads and torques" . . . D. J. Davis, vice president-manufacturing, Ford Motor Co.—Conference keynote speaker.

Specific information on internal slippage in spool type control valves is desired.

Ben Blake, Scovill Mfg., said knowledge of valve slippage would help the designer in selecting proper pump size and would give a measure of the expected accumulator discharge through a supposedly closed center valve. It would also give an indication of the expected cylinder creep or feed variations caused by oil slippage.

Variations in manufacturing tolerances, operating pressures, and valve wear make it impossible to give reliable slippage data.

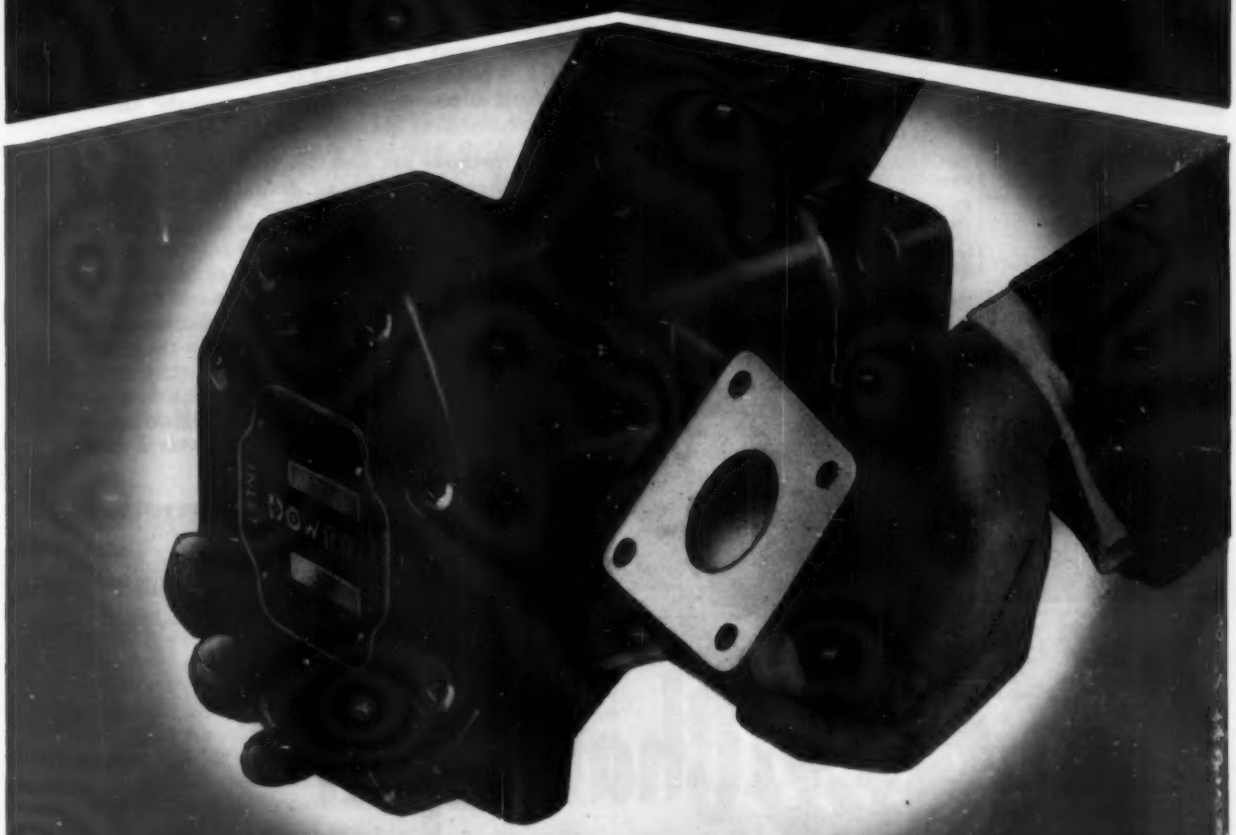
What's being done to standardize hydraulic components to provide absolute interchangeability?

Speaking for a machine builder, R. A. Winblad of Cincinnati Milling, asked for interchangeability of mountings between various manufacturers, pumps, valves and cylinders. He would like to see the ultimate in interchangeability as attained by radio tube manufacturers. Interchangeability reduces stocking problems and would be very desirable from the standpoint of National Defense.

What's being done about establishing mounting standards? Some manufacturers are giving standardization serious consideration. It is going to take time.

KEEP THINGS

under better control



Dowty hydraulic components of high efficiency and low cost are keeping heavy work under finger-tip control.

These pumps are available in fourteen sizes from 1 to 50 gals./min. with pressures up to 6,500 p.s.i.

Write for Design Details Today.

DOWTY

hydraulics

FOR INDUSTRY

PUMPS • RAMS • CONTROL VALVES • COUPLINGS

DOWTY HYDRAULIC UNITS LIMITED • ASHCHURCH • GLOS • ENGLAND

DOWTY CORPORATION, 37 BEAVER STREET, NEW YORK, 4
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Members of the DOWTY Group

Circle 112 on Reader Service Card

"MONOBALL"
Self-Aligning Bearings

CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Moly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Moly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Address Dept. AH-55.

SOUTHWEST PRODUCTS CO.
1705 So. Mountain Ave. • Duarte, California
(LOS ANGELES COUNTY)

FABRICATING MACHINERY

Continued

PETROLEUM FLUIDS

What's the effect of excessive heat on hydraulic mineral base liquids?

Jack Van Gundy, Texas Co., answered this question. Heat thins out oils and causes oxidation. Using a premium fluid having oxidation inhibitors, oil life to 4 or 5 years is possible if temperature is held to 130 F as recommended by J.I.C. Elevated temperature has little effect on lubricity so long as the viscosity remains above 45 SSU.

What methods are employed by users to determine when hydraulic oil should be discarded?

Detroit Diesel's J. J. Yates told about their program which is set up to discard oil only when necessary. They do a periodic sampling to make a check on the amount of dirt, water or coolant contamination, and neutralization number. On the particular oil used in their plant, a limit of .35 is placed on the neutralization number. This limit can't be generally applied to all oils. Rate of change of neutralization number is most important. Detroit Diesel's program has resulted in reduced pump, valve and general circuit maintenance.

What improvements are needed in petroleum hydraulic oils?

Less viscosity change with temperature; more wear and rust protection are being asked for by users.

Char-Lynn
HYDRAULIC HORSEPOWER PRODUCTS

HI-LO-PAC PUMP
Model 600—In one compact unit offers: 2 pumps (gear type), 2 valves (single & double), 2½ gallon reservoir, relief valve (1000 psi), filter, delivery up to 12 gpm. Tractor Mounting Kits available.

HYDRAULIC RAMS
Model 1032 *Strokontrol Ram* has 3½" bore; 8, 13 or 16" stroke. Double action with hydraulic depth stop.
Model 1002 *Horsepower Ram* has 3" bore; 8, 10, or 12" stroke. Double action converts to single action.

HORSEPOWER VALVE
Model 960 with Holdkontrol provides manual or automatic return to neutral. Has built-in 1000 psi pressure relief valve. No additional ports to convert from double to single acting.

HORSEPOWER PUMP
Model 400—A basic high-speed Gerotor type pump. Delivers 10 gpm at 1750 rpm. Maximum pressure 1500 psi.

HYDRA-SEAL COUPLER—Model 730 Hose Coupler allows free flow when connected. Self-sealing on break-away . . . Oil sealed in, dirt sealed out. Free flow allows maximum operating efficiency.

Hydraulic Horsepower To Serve You Better
CHAR-LYNN COMPANY
Dept. AH 75 2843-26th Avenue South, Minneapolis 6, Minnesota

Char-Lynn COMPANY

For more information— WRITE FOR FREE CATALOG!

FIRE RESISTANT FLUIDS

R. Q. Sharpe, Socony Mobil Oil Co., briefly discussed the available fire-resistant fluids. He divided them into three groups: straight synthetic, water-base, and soluble oil emulsions. The last group are still experimental. The straight synthetic or phosphate type has been in use for about 5 years. They have oxidation stability, freedom from deposit formation, good anti-wear characteristics and provide satisfactory protection against rust. They have a damaging effect on seals used with petroleum base fluids and they are excellent paint removers.

Water-base fluids are mixtures of water and polyglycols. They work well with gear and vane pumps below 1000 psi. However, pump maintenance costs are higher than when using petroleum fluids. Applications with high pressure piston pumps are still in the experimental stage. While water level must be maintained, this does not offer any problem if the operating temperature is held at 130 F or under. Film strength and protection against wear appears to be adequate. There is good protection against rust and the water-base fluids are generally compatible with seals used on petroleum oils. Good paint remover.

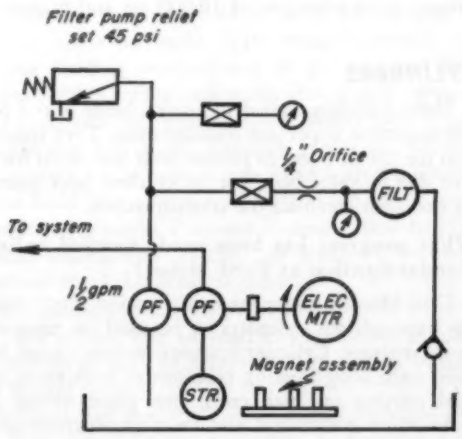
Results of tests with emulsions indicate that their use may be restricted to systems using rotary type pumps operating below 400 psi. These emulsions are an approach to a low-cost fire-resistant fluid.

STRAINERS AND FILTERS

Where do you use and how do you select and clean pressure and suction filters?

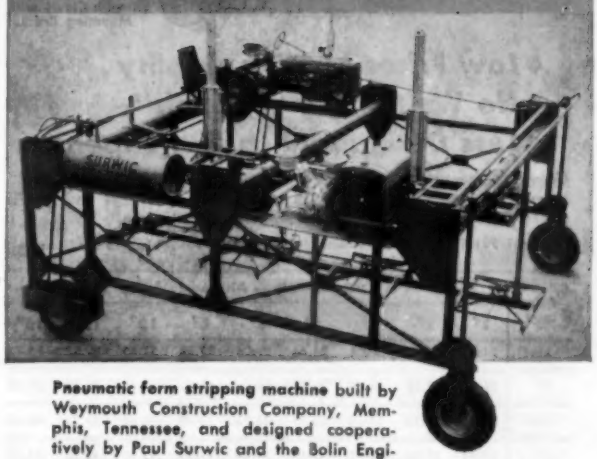
It was generally agreed that filtration on the suction side of the pump should be limited to strainers which are no finer than 100 mesh, because pumps will tolerate some contamination but cannot tolerate starvation. Don Morrell, Ford Motor Co., expressed preference for use of an activated clay bypass filter, because it holds down the neutralization number, can be accessibly located and will filter down to 3 microns. On a bypass filter installation, a pressure gauge indicates when the element needs changing.

E. Lutat, A. C. Spark Plug, showed the circuit using a separate filtering pump as their preferred



filtering method. They also use a suction strainer on the main pump which has a capacity of 3 times pump delivery for petroleum base oils and 4 times delivery on water-base fire-resistant fluids, Magnetic plugs in the tank remove ferrous particles.

TWO MEN DO THE WORK OF ELEVEN with unique form stripper equipped with Westinghouse Pneumatics



Pneumatic form stripping machine built by Weymouth Construction Company, Memphis, Tennessee, and designed cooperatively by Paul Surwic and the Bolin Engineering and Supply Co., the Westinghouse control distributor in Memphis.

This new pneumatic form stripping machine removes forms from articulated pre-cast concrete mattresses used on the levees of the Mississippi River. Previously, forms had been stripped manually, and it was a time and labor consuming job. With the pneumatic form stripping machine, just two men now remove 30% more forms than 11 men could strip manually.

If you have a machine that might be improved with pneumatic controls—if you have pneumatic equipment to be revamped or serviced, call your nearest Westinghouse Distributor or write to Westinghouse Air Brake Company, Industrial Products Division, Wilmerding, Pennsylvania.

Westinghouse Air Brake COMPANY

INDUSTRIAL PRODUCTS DIVISION WILMERDING, PENNSYLVANIA

Circle 132 on Reader Service Card

NOPAK Shelf-Stock Cylinders

- **Low Prices but Top Quality**
- **No Waiting for "Specials"**
- **Less Design and Layout Expense**

Compare the prices and scope of NOPAK Shelf-Stock (1½ to 8" bore with 1 to 15" stroke) with competitive offerings and you'll specify these NOPAK Class 1 cylinders to cut costs.

LIST PRICES F. O. B. Milwaukee, Wisconsin — Subject to Revision

Cyl. Dia. Bore	STOCK STROKE LENGTHS — All Double Acting								
	1" ○	2"	3"	4"	5"	8"	10"	12"	15"
1½"	24.16	25.72	26.08	26.44	27.16	27.88	28.60	29.32	30.40
2"	26.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
8"	———	126.80	129.20	131.60	136.40	141.20	146.00	150.80	158.00

● **Basic mountings "A" and "E" (see above) convertible to "B", "C", "D", or "F" (see below) by changing heads. Add 10% to above list prices (no extra charge for 8" bore.)** ● **Piston rods have B-1, NF male thread.** ● **Cushioning can be eliminated on either or both ends by removing spring and ball-check.**

NOTE: Class 1 cylinders listed, for Air or Oil to 300 psi. Water use requires 1 week delivery for chrome plating of steel components.

NOPAK 4-Way Valves (¼ to 2" IPS) hand, foot, solenoid or pilot operated, to actuate all cylinders, also in Shelf-stock.

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NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

NOPAK Shelf-Stock also maintained in other principal cities. Write for list.

A 8367-½V

FABRICATING MACHINERY

Continued

MAINTENANCE

How to get more equipment into less space?

To a maintenance man, this appears to be the machine builders chief aim in life. Ed Lerczak, Oldsmobile, said that they try to locate machines and place piping on the machines to provide at least 30 degrees of movement with a standard wrench. The guide to proper spacing is accessibility.

What equipment should the user have for running tests on hydraulic equipment?

For checking components on the machine, the user needs pressure gauges, a stop watch, a tachometer, a thermometer and ingenuity. To do component testing some users have installed test stands.

MANIFOLDS

What types of manifolds are available?

Brazed or bonded cold rolled steel or cast meehanite sandwich manifolds and drilled aluminum blocks are being used. For large sizes the sandwich manifold is favored. Brazed manifolds have been used on systems operating at 2000 psi for approximately four years. In the few cases, where leakage developed between channels of the brazed manifolds the plates had to be scrapped.

No builder of a fabricating machine reported any experience with sandwich manifolds held with cement type bonding materials.

What are the advantages of pipeless presses?

W. R. Lau of Oliver Corporation said that maintenance may not be reduced on pipeless presses because the man spends "more time hunting than fixing". Today, the use of gasket mounted valves and manifolds eliminate some of the advantages of the pipeless press. Flexibility may be hindered on the pipeless design, and of course this design cannot be applied to multi-cylinder jobs.

The pipeless design proves very beneficial on presses using pressures of 10,000 psi and higher.

CYLINDERS

Users said they considered accessibility of rod packing as a most important consideration. They indicated that the use of boots to protect rods was often ineffective due to short boot life. A cracked boot provides an excellent catch-all for contamination.

What progress has been made toward cylinder standardization at Ford Motor?

Don Morrell answered this question. Ford has set up standards for cylinders to be used on equipment in their shops. Cylinder features include: large hardened rods; long floating cushions at both ends; large dual porting on both ends; one piece torque type locknuts on piston rod and tie rods; interchangeable check valves and cushion adjustment valves; cartridge containing nonadjustable rod packing, wiper and bearing; "O" ring static seals; steel heads and mountings; standard dimensions for rod diameter, rod thread and length, port sizes, mountings and maximum cylinder envelope.

FITTINGS AND TUBING

How do you stop leaks?

This is always the BIG question. Russ Hemeon of Ternstedt-Trenton answered it by showing the excellent results which have been obtained by: proper piping, correct operating temperature, careful design, use of 6000 psi double wire braid hose even on machines operating at 600 psi, quality pipe thread cutting, trained mechanics. All easier to tell about than to do. There was discussion about adopting AN straight threads instead of taper pipe threads and there was discussion about eliminating threads entirely by the use of welded flange fittings.

How do you stress relieve welded fittings on a large assembly?

S. H. Durbin, E. W. Bliss Company, described their technique on large assemblies. Piping runs are assembled on the machine and then flange fittings are tack welded. They are then removed to the bench and as a welder lays a bead, a helper peens it while hot. The piping is then reassembled on the machine and where stress relieving is necessary, the pipe is reheated at two places in opposite directions. Any scale which is formed is removed by pickling.

Some users reported that they are silver soldering flange connections. These have been in service for pressures to 3000 psi. Induction heating was recommended as the ideal method for accomplishing the soldering operation with minimum distortion of the fitting. ▼▼▼

CHANGING TO FIRE-RESISTANT FLUID?

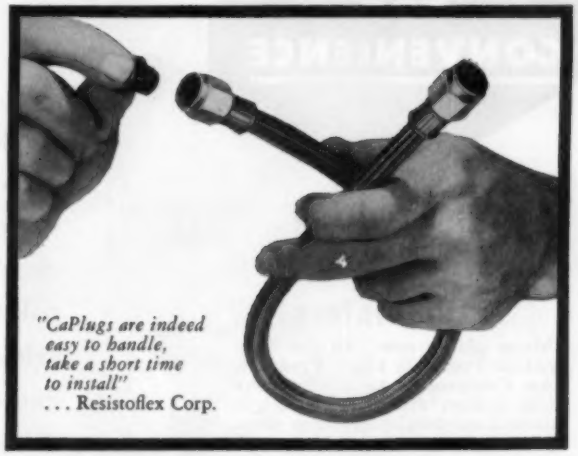
Concluded from page 68

verted motor-pump-tank unit installed and the machine ready for operation, a flushing run is made with a 50/50 solution (50% fire-resistant fluid, 50% water). Relief valves are set at 150 psi for this run. After a "dry run" of at least 30 minutes, a check is made for leaks. With these corrected, the flushing fluid is pumped out of the system. Side cleanout plates on the tank are removed and the tank walls and baffles are flushed down. Water is removed and filters are cleaned. The side plates are permanently placed. The tank is now filled with the fire-resistant fluid and a "dry-run" at 150 psi for at least 30 minutes is made. Pressure is then raised to production setting and another 30 minute "dry-run" as a final check for leaks is made.

This entire conversion procedure requires absolute cleanliness. Use of restricting elbows, nipples and unions should be eliminated by use of tubing with liberal radii.

You will find that the cost of a thorough conversion is justified by the reduction in maintenance. Unless you are willing to authorize a necessary adequate project expenditure, to cover a well formulated conversion program, you will be faced with excessive operating and maintenance costs plus a high price for fluid leaks. ▼▼▼

see how CaPlugs can protect your products



"CaPlugs are indeed easy to handle, take a short time to install" ... Resistoflex Corp.

Just push them in! That's how Resistoflex applies CaPlugs to keep aircraft hose assemblies clean.

Because they're flexible, these tapered, non-threaded closures slip on easily over plain or threaded fittings or insert readily into round openings . . . to safeguard products during process, storage and transit.

Already in use by thousands of industries on numerous types and makes of tubing, valves, hydraulic components, fittings and machined parts, CaPlugs are easy to spot. ***They're red!***

Made of Polyethylene, CaPlugs will not collapse, chip, break or shred under most severe conditions . . . are impervious to all common chemical reagents, acids and solvents. They're plenty *tough* . . . yet extremely *kind* to threads and polished surfaces.

Furnished in five standardized cap and plug designs (both threaded and non-threaded), CaPlugs are stocked in over 200 sizes (up to 8" in dia.) to meet most needs. Make sure you receive complete details and prices.

write for this FREE assortment

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PROTECTIVE CLOSURES CO., INC.

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NEW ECONOMY and CONVENIENCE

For Servicing Hydraulic System Accumulators

Many plants now use the Cornelius Portable High Pressure Air Compressor to service central system and individual hydraulic accumulators. This compressor is entirely portable and can be moved easily to any point in the plant.

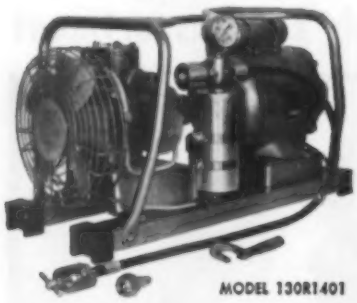
Machines Requiring Special Pressure

The Cornelius Air Compressor can service individual machines requiring any accumulator pressure up to 3000 pounds per square inch. It is simple and economical to operate.

Cornelius

PORTABLE AIR COMPRESSORS

For Pressurizing Hydraulic Accumulators and Air Cushions



MODEL 130R1401

Charge Accumulators Directly with Air or Recompress Nitrogen to Usable Pressure

Two basic models with capacity of 0.6 to 2 SCFM and pressures to 3000 pounds per square inch. Largest model weighs less than 60 pounds complete with electric motor. All standard motor windings available.

We invite your inquiry. Ask for Product Sheet No. 5

THE CORNELIUS COMPANY

560 39th Avenue N. E.
Minneapolis 21, Minnesota

Ideas from a Sales Engineer

Elmer F. Heiser

During Elmer Heiser's 18 years of selling air and hydraulic components, he has solved many problems and has left some unsolved. Between, much too infrequent fishing trips to Canada, Elmer makes his sales calls in northern Ohio. He is the author of the recently published book "*Air and Oil Cylinders in Industrial Applications*". Because we enjoy learning of Elmer's experiences and opinions, we've asked him to write these monthly columns. We hope you too are finding these columns amusing, interesting and informative.

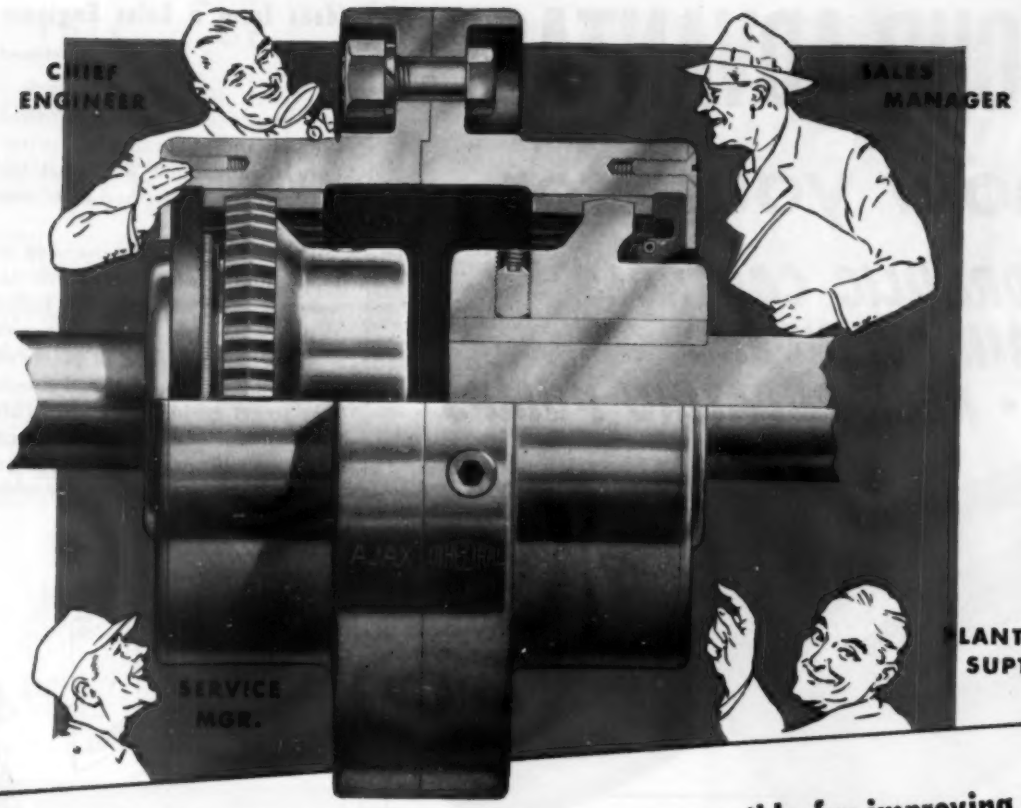
All about dogs and circuit symbols

THIS fellow had a good dog. He knew his birds and rabbits and was an all around outdoor operator (the dog that is). When they moved into town, it was necessary to keep the dog in the house most of the time. As an outdoor dog, not accustomed to the niceties of protected living, there were some things he did not know. For example, he could not tell the difference between green carpet and green grass. At least he had about the same respect for one as the other.

At the first evidence of this failure to differentiate, the master of the house proceeded to drive home a lesson. He grabbed the dog by the scruff of the neck, pushed his nose into the oversight, opened the window and tossed him out. The next day, when nature called, the dog responded as before, then contemplating the window for a brief instant screwed up his courage and went through with a crash.

You see the idea that there was some connection between nature's calls and the outdoors got through. But the mutt missed two points in the lesson. His timing of the exit in relation to the urge was way off and he completely missed the knack of opening the window. All of which could be used to prove that it is sometimes difficult to teach an old dog new tricks.

So it is with anything new which upsets the old order. Part gets through but we set up a natural resistance to any change which requires learning all over again. Those of us who have been fooling with fluid power equipment for a long time grew accustomed to our own "outdoor" methods of mak-



A Personal Message to the man responsible for improving your product performance and competitive reputation

● This alerts your attention to a basically improved field-proven coupling for direct connected machines. Whether you are president, vice president, general manager, sales manager, design engineer, production engineer, superintendent, director of purchasing or installation engineer, remember that all your horsepower goes through your couplings.

AJAX Dihedral Couplings handle angular, offset and end float misalignment heretofore impossible with conventional flexible couplings, and you can design accordingly!

AJAX Dihedral tooth design permits holding tooth clearance (backlash) to lubrication film requirements,—*engineers will welcome THAT!*

Gear teeth are hardened to 50-55 Rockwell C, another exclusive AJAX feature on standard couplings!

AJAX seals keep lubrication in, foreign matter out,—*maintenance men welcome THAT!*

Assembly and installation costs are cut to minutes instead of hours, *and everybody welcomes THAT!*

Savings on down-time losses pay for AJAX Dihedral Couplings over and over, *and everybody welcomes THAT!*

AJAX Dihedral Couplings have been proved and approved by five years of field service on rolling mills, cranes, generators, dredges, pumps, earth moving and other heavy duty equipment.

Phone the AJAX representative or write the factory for case histories, and you will spark-plug some worthwhile thinking.

Also manufacturers of a complete line of AJAX Rubber-Bronze Bushed Couplings and Vibrating Conveyors.

Representatives in Principal Cities

Consult your Telephone Directory

AJAX

DIHEDRAL COUPLINGS

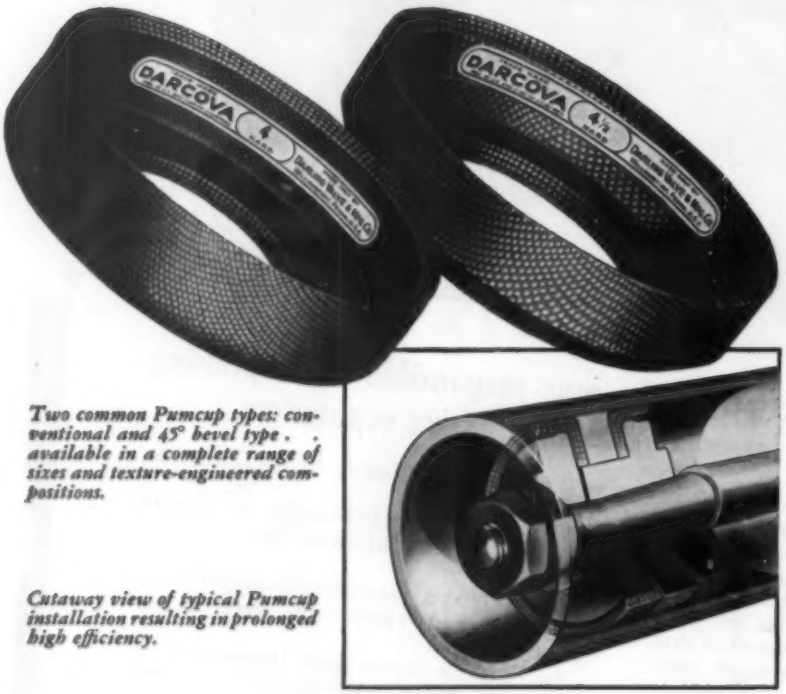
AJAX FLEXIBLE COUPLING CO. INC.

WESTFIELD, N. Y.

PUMCUP ADVANTAGES

now yours for

- HYDRAULIC CONTROLS
- AIR CYLINDERS
- RECIPROCATING PUMPS



Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.

Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary piston packing . . and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

Improved application of the cup principle does the trick. And Darcova Pumcups are *texture-engineered* in *a range of compositions* to meet most temperature-pressure-fluid conditions. And they are available in sizes and types exactly right for your particular equipment.

It will pay you to get *all* the facts. Just ask for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
TRADE MARK
PUMCUPS

ing diagrams. The standardized symbol and diagramming procedure requires that we forget the old familiar process and learn new tricks.

Each of us who had occasion to make fluid power diagrams developed his own methods. We found that a square or a rectangle with some connecting lines at points of our choosing was a fast and simple way to get an idea on paper. This was satisfactory so long as each read his own drawings or was on hand to act as interpreter. Trouble developed when it was necessary to understand the ridiculous diagrams concocted by others. Obviously anyone who had to interpret a number of different types and styles of diagrams from a number of sources, was really in a mess. So the stage is set for a standard diagram procedure.

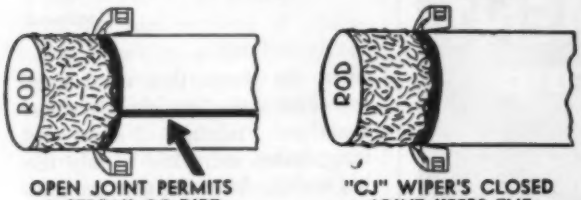
"His application said he was an expert on symbols."

Why any resistance?

The full explanation isn't natural resistance to change. Perhaps if the established standards had resulted in a procedure comparable in simplicity to those it replaced much of the resistance would not exist. This is not the case. The old dog finds that instead of slapping a rectangular shape on the paper with an identifying number or description, he must first read the

Circle 1 on Reader Service Card

This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For those dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint

(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use the 3 Piece FALL WIPER RING FWR-3C**

Spec. Mil-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) and endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Co., Toledo 1, Ohio

Fall Wiper Ring SPRING LOADED

Phone Adams 6813

Covered by patents issued and patents pending.

WIGGINS INST-O-MATIC COUPLINGS

QUICK—DISCONNECT

use **WIGGINS COUPLINGS** for

OIL
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HYDRAULIC OILS
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REFRIGERATION
COOLANTS
HELIUM
NITROGEN
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FUEL OIL
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Manual Quick Disconnect (Push-Pull Positive Action)

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SIZES: ¼" TO 2½

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What a sight!

CENTURY'S All-new Oil Level Sight Gage

No Easier Installation Ever Designed

Better Visibility at any Height

Streamlined Modern Appearance

Leak-proof —No Dripping

Important Savings in COST

Available NOW From STOCK!

Inquire today . . . make immediate use of the sensational advantages in cost and services offered by this new gage . . .

CENTURY HYDRAULICS, INC.

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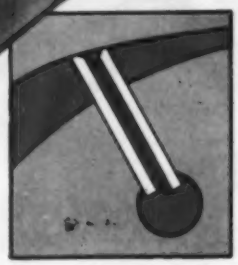
DUDCO PRESENTS . . .

for MOBILE EQUIPMENT

a New Dual-Vane Pump



2000 psi Continuous Duty
3 to 11 gpm at 1200 rpm
0 psi

This Pump was engineered to meet the special conditions characteristic of service on mobile equipment.

Here is a pump designed for high speed direct engine drive that can be operated *continuously* at *2000* psi and *2000* rpm to meet the continuing demand for more work from your equipment.

TWO VANES ARE BETTER THAN ONE

The hydraulically counterbalanced DUAL-VANES in DUDCO Hydraulic Pumps eliminate wear producing loads normally caused by unbalanced hydraulic forces and vane acceleration. DUAL-VANES also maintain MULTIPLE SEALING BARRIERS to slippage and power loss. DUAL-VANES are a patented and exclusive DUDCO feature.

The exclusive DUDCO Dual-Vane design provides and assures *complete hydraulic balance* of all internal parts. Bearing loads and cam ring wear are reduced so DUDCO PFM-100 Pumps last longer.

Designing these Pumps into your machines is made easier because all standard S.A.E. or industrial mountings and piping provisions are available, as well as complete flexibility of port positions.

PFM-100 Series Pumps are priced for the competitive mobile equipment market . . . NO price penalty for high pressure equipment.

Write — for complete information on the new DUDCO PFM-100 Series DUAL-VANE Hydraulic Pump.

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THE NEW YORK AIR BRAKE COMPANY
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Ideas from a Sales Engineer

Continued

rules. He learns that some lines are solid, some are short dashes, some are a mixture of short and long dashes etc. This is only the beginning. After he gets an idea of the types of lines to be used and their purpose, he must study the individual symbols and then learn to combine these basic symbols to show complex units. He winds up studying a model symbol of a combination unit such as a pilot type solenoid valve, which has been made by one who is informed. After he makes his to look like the model, he may find that the originator took some liberties.

He will learn that certain liberties are acceptable, if the idea gets across and if the recipient is not too precise. On the other hand, he may find that the liberties are not acceptable and must be corrected to correspond to the letter of the law.

We know one case where one who is thoroughly familiar with the standards, having used them regularly since their introduction, prepared a number of relatively simple JIC circuit diagrams. The minor "liberties" taken or the deviations based on individual interpretation were generally acceptable. However, numerous "errors" were pointed out. One study turned up twenty eight violations of strict standards in the drawings.

CAN THERE BE UNIFORMITY?

It has been pointed out that standard diagram procedure has long been established for electrical equipment. Further, the close parallel between electrical and hydraulic operation indicates that the diagramming should be similar. There are only a limited number of symbols which cover the average electrical circuit but the many variations in fluid power equipment can result in an unlimited number of combinations. Diagram procedure for the variations is left to the judgment of the layout man. A new piece of equipment containing a series of valves etc. will appear different in the diagram each time another man cooks up a layout. It is doubtful if any two per-

sons will have the same notion as to how it should be shown.

In one case a piece of equipment containing a number of integral valves was to be incorporated into a circuit. A heated discussion as to procedure developed when one draftsman wanted to show the unit as a circle only with an appropriate label. Another insisted that it should be "opened up" on the circuit diagram to show the function of each element. Who is right?

One man could use a small drawing and his symbol for the element would take 2 or 3 minutes drawing time. The other would require a sheet twice as big and would spend so much time on one element in the layout as the first guy spends on the entire drawing.

The time required to make diagrams in accordance with the standards is without a doubt a point of resistance. Add to this the matter of individual judgment and interpretation which may be accepted one time and criticized another and you can see that the normal reluctance to change may be only a minor factor in the whole picture.

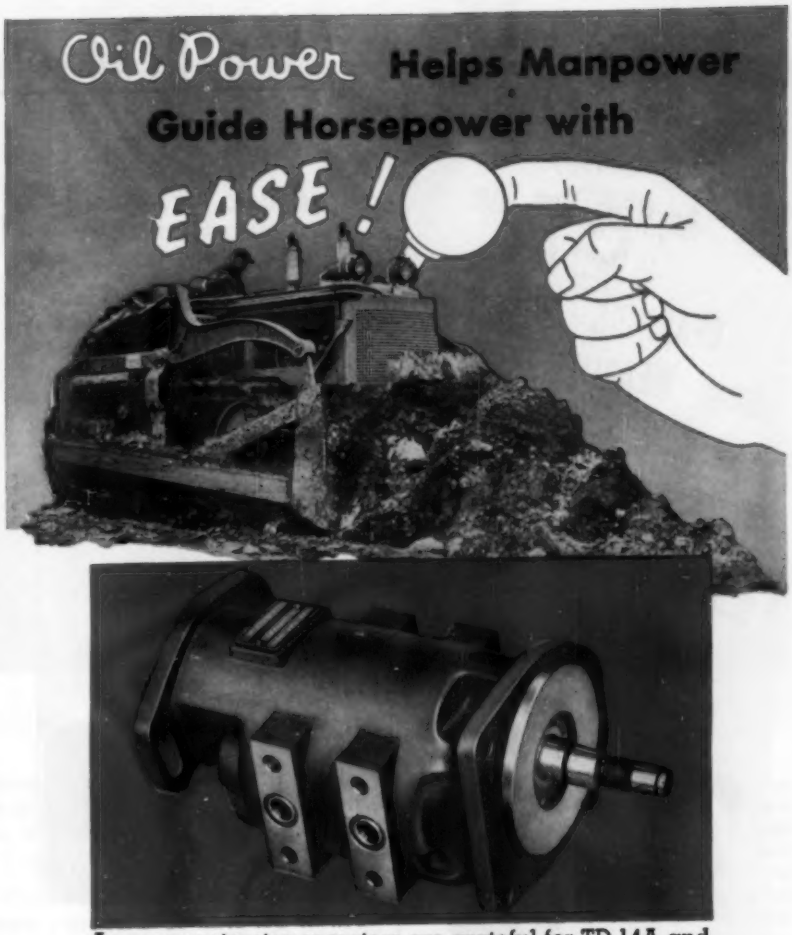
Preprinted symbols or drawing guides answer only a part of the general standards problem. The elasticity now prevailing deserves some further attention. There should be a solution that utilizes the universal possibilities of JIC standards and at the same time eliminates the ancient oriental system of unlimited characters to tell a story.

You figure it out while I go get some glass for a window. ▼▼▼

Next month:
What's the life of the equipment?

EDITOR'S NOTE:

We agree with Mr. Heiser on the poor handling of the dog. We don't fully agree with him on JIC symbols. With so many new valves being developed, some flexibility in preparing symbols is necessary. The purpose of the symbol is to show the flow path of oil through the valve for all operating positions. If this is accurately done the symbol should be considered correct.



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New Products continued

HYDRAULIC FITTINGS
. . . assure positive seal

Designation: CN

Design: Newly designed fittings have straight threads which lock fitting in place and seal valve or pump port from fluid leakage. Fitting does not overstress or damage port or fitting as sometimes happens with pipe threads.

Features: Fittings reduce installation time, because no dope or sealer

is necessary. There is no valve distortion, and fittings may be reassembled repeatedly without damage to port or fitting. Elbows and tees can be positioned without overtorque of threads, allowing perfect alignment with tube or hose lines without stresses.

Application: Fittings are for L & L type and AND 10050 ports. The latter requires an additional O-ring. All fitting shapes are available with sizes ranging from ⅛ to 2-inch OD tubing sizes.

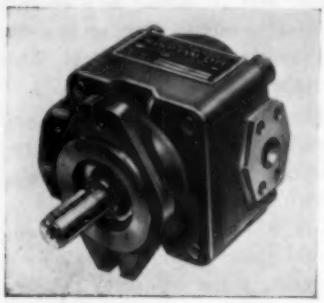
L & L Manufacturing Co.
Van Dyke, Michigan
Circle 198 on Reader Service Card

VANE PUMP
. . . for mobile equipment

Designation: Series PFM-100

Features: Pump is designed for high speed direct engine drive. For continuous operation at 2000 psi, pump is rated at 3 to 11 gpm at 1200 rpm, but may be operated at speeds to 2000 or 2600 rpm depending upon pump size.

Design: All standard SAE and industrial mountings and piping provisions are available, as well as complete flexibility of port positions. Dual vane design provides multiple fluid seals to reduce slippage and power loss to a mini-



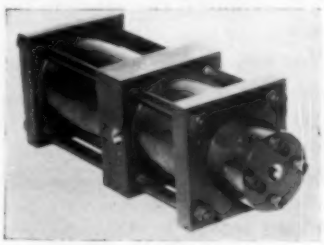
mum. Shaft bearing loads, rotor side loads, and excessive vane-thrust loads are eliminated by complete hydraulic balance of all internal parts.

Dudco Division
The New York Air Brake Co.
Cleveland, Ohio
Circle 199 on Reader Service Card

BOOSTER
. . . for pressure to 1951 psi

Design: Ratio of air pressure to hydraulic pressure is 19.7 to 1 producing an output pressure of 1951 psi with an input of 100 psi or 1660 psi with an input of 80 psi. The 5-in. air cylinder drives a 1⅛-in. hydraulic ram which delivers .994 cu. in. per in. of stroke.

Features: The booster can perform work that would otherwise



require cylinders many times the size. The need for special hydraulic pumps, relief valves, reservoirs, and piping is eliminated. The space-saving booster is designed to be used where heavy concentrations of power are needed for punching, pressing, clamping, etc.

Airmatic Valve, Inc.
Cleveland, Ohio
Circle 200 on Reader Service Card

Continued on page 114

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A MASTER REFERENCE FILE in a handsome hard cover bound single volume, thumb notch indexed for easy reference. A reference manual of infinite value to designers, engineers and specialists in fluid power application and operation. Covering hydraulics and pneumatics. Manufacturers will present their own catalog or specification sheets in this book.

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THE RONALD PRESS COMPANY
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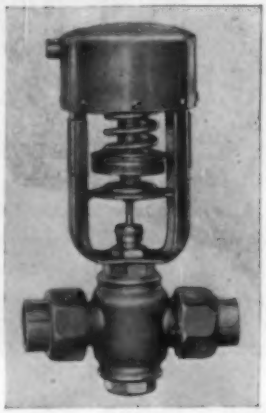
New Products continued

MOTOR VALVE
. . . for oil and air control

Designation: No. 992-D



Applications: Recommended for control of water to heat exchangers for cooling of hydraulic systems. Also employed in hydraulic and pneumatic systems to maintain pressure and liquid level.

Specifications: Valve has a linear movement and is available in sizes from ¼ to 4 in. in a variety of types. Can be supplied in either direct or reverse acting styles.

Fulton Sylphon Div.
Robertshaw-Fulton Controls Co.
Knoxville, Tenn.

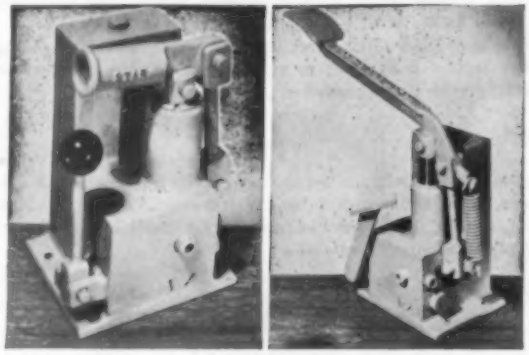
Circle 201 on Reader Service Card

VARIABLE VANE PUMP
. . . has compensated flow control

Designation: Multipump

Features: Delivery is easily changed with flow control knob. Delivery remains within 5% of setting regardless of pressure variations or changes in pump speed. Delivery of pump is controlled by system pressure; flow in excess of that needed by the system is unloaded to tank at zero pressures. This gives a horsepower savings up to 75% over a constant delivery pump with con-

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



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Two speed construction provides automatic change-over during operating cycle from high speed low pressure to low speed high pressure.

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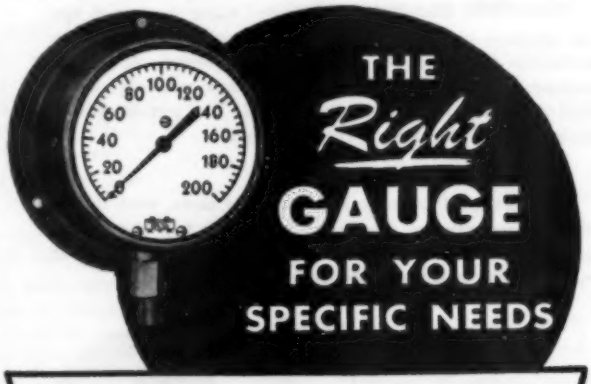

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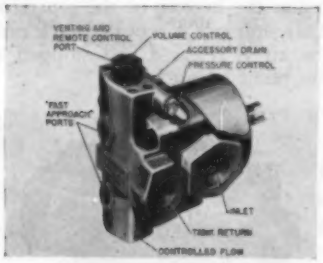
Circle 86 on Reader Service Card

ventional flow controls. Relief valve is eliminated in many cases. Pressure compensator can be controlled remotely.

Applications: Pump can be used for variable volume, constant speed jobs on machine tools replacing a



hi-lo pump arrangement. Unit can also be used for constant volume with variable speed in mobile equipment.

Specifications: Deliveries of 5, 15 and 25 gpm at 1200 rpm or 7.5, 22.5 and 37.5 gpm at 1800 rpm are obtainable. Units are designed for 1000 psi continuous duty.

The Denison Engineering Co.
Columbus, Ohio
Circle 202 on Reader Service Card

LUBRICATING FINISH
. . . for tube fittings

Features: Finish provides a "built-in" lubrication for the fitting and reduces the wrench torque required

to install the fitting without oil. The finish gives adequate protection against normal industrial atmospheric conditions wherever it is practical to use steel tubing.

Parker Appliance Co.
Cleveland, Ohio
Circle 203 on Reader Service Card

AIR FILTER
. . . with automatic discharge

Design: Compact unit requires no hand draining. As air flows through the unit, water and all foreign substances with a specific gravity greater than air collect in the main filter chamber of the unit. Upon the sudden stopping of this air flow, an internal valve changes position.

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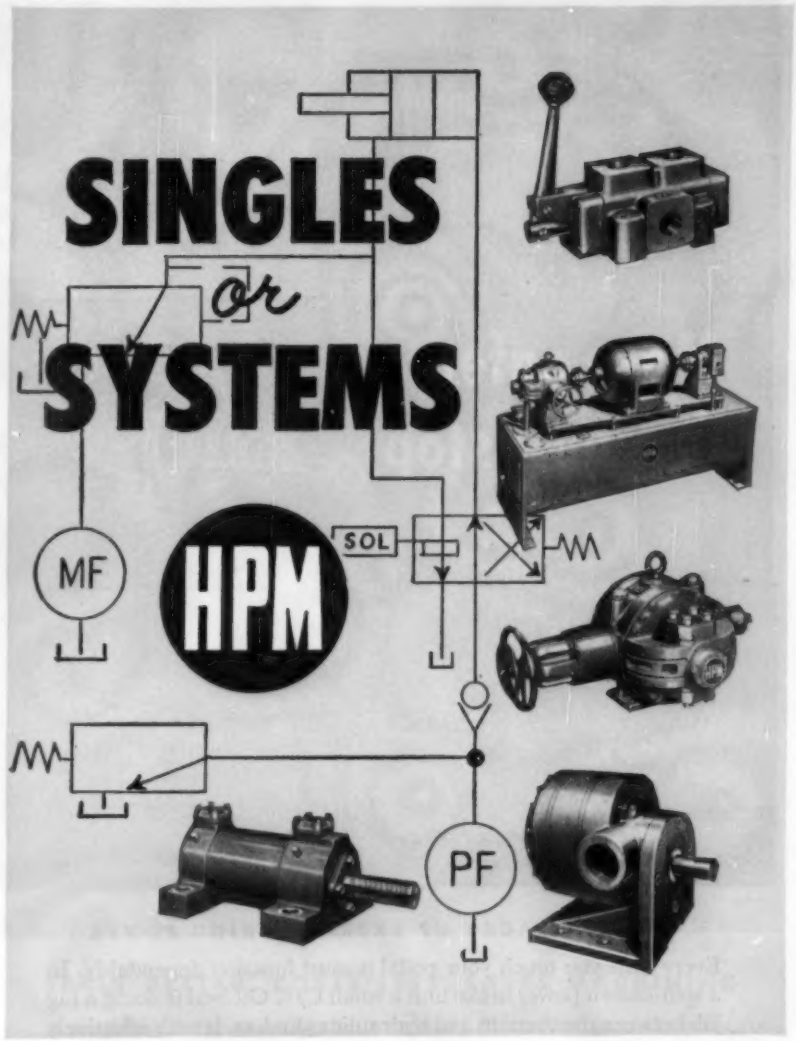

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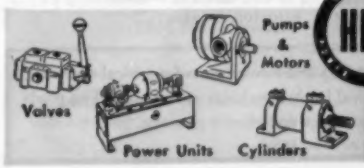

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Every time you touch your pedal it must function dependably. In a well-known power brake unit a small C/R Oil Seal is doing a big job between the vacuum and hydraulic cylinders. It seals effectively on both sides, withstands pressures to 10 psi, and provides maximum flexibility to follow possible eccentricity up to .025". And there has never been a failure in the field. If your product must conform to equally high standards, consider C/R Oil Seals. For basic information let us send you a copy of "C/R Perfect Oil Seals."

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1301 Elston Avenue OIL SEAL DIVISION Chicago 22, Illinois

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New Products / continued

During this instant, the full line pressure purges all water and foreign substances through the opening at the bottom of the separator. This sequence is repeated each time the air is released and stopped at the point of use.

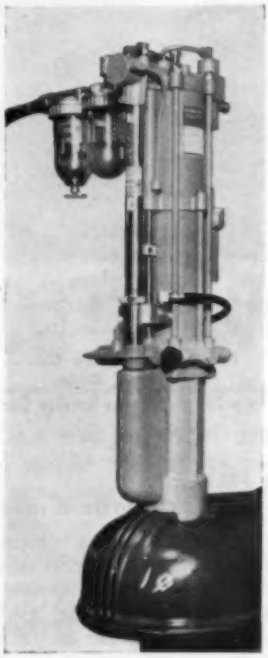
Specifications: Unit weighs 1¾ lb and is designed for a working pressure of 200 psi maximum. Inlet and outlet are for ¼-inch pipe. Material is all non-ferrous metal.

Engman Manufacturing Co.
Des Moines, Iowa

Circle 204 on Reader Service Card

PNEUMATIC DRILL FEED . . . for deep holes

Application: Unit has fast approach to work then automatically



feeds and retracts to remove chips, and allow entrance of coolant. By operating a valve, this step-by-step

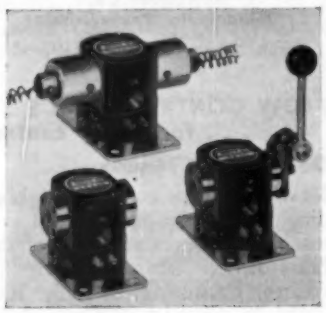
drilling is changed to a cycle having only rapid advance to work and controlled feed to a predetermined depth. Unit is adaptable to most makes and models of drill presses, and can operate in any plane. Feed has no electrical or hydraulic devices.

The General Pacific Corp.
Los Angeles, California

Circle 205 on Reader Service Card

AIR VALVES
. . . with built-in speed controls

Features: Twenty-four models of 4-way valves are available with ¼, ⅜, or ½-in. ports for operation from 5 to 150 psi. These include double-solenoid, air bleed, air pilot, and hand types. Double solenoid and air bleed models are supplied for either 8 or 110 volts and have momentary contacts. Hand type and air pilot type are offered either for double actuation or spring return.



Construction: Connectors are furnished with the solenoid valves and the coils are molded in resin and are completely impervious to moisture. All friction surfaces are hardened and permanently coated with a baked-on lubricant.

A. K. Allen Co.,
Brooklyn 22, N. Y.

Circle 206 on Reader Service Card

DIAL THERMOMETERS
. . . are easily read

Design: Bimetallic thermometers are accurate to 1% of range at any point of indication. Stems are ¼-inch stainless steel, all welded construction and are available in standard lengths of 4, 6, 9, 12, 18, and 24 inches for bottom or back connection. Faces are black on white or white on black. 5-inch case is made of pressure-cast aluminum alloy with black crackle finish and is moisture-proof with a strong fume-proof bezel. Link ge between the bimetal shaft and indicator shaft

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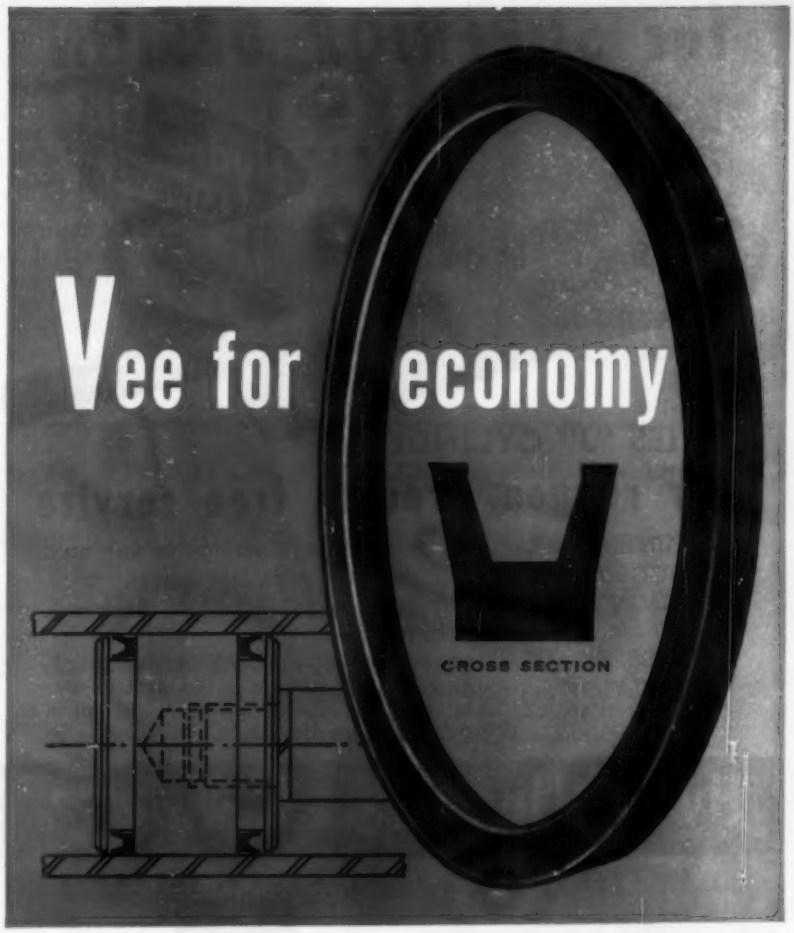

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A single C/R Sirvene (synthetic rubber) Block Vee, in most cases, will seal as effectively as an entire stack of ordinary multiple vees. Assembled in the groove of a hydraulic piston, the Block Vee will permit the use of larger tolerances, but will not roll or twist like an O-ring. The double-angled lip provides greater flexibility with lower friction and longer service life. Under pressure both lips are loaded to form an effective seal up to 5000 psi. Perhaps this part will help you design for lower cost. Ask a C/R Sirvene engineer.

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for rugged, trouble free service

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- *RUGGED BODY . . . all steel end caps and barrel.*
- *PISTON RINGS . . . step-cut joint, sealing in both directions, long life, minimum leakage.*
- *PRESSURE . . . 2,000 psi heavy-duty . . . 3,000 psi non-shock.*
- *SIMPLICITY . . . no tie-rods . . . no retainer rings.*

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5837 South Ashland Avenue Chicago 36, Illinois

New Products / continued

includes proper bearings to minimize friction losses and sticking.

Features: Both pointer and scale

can be set to any position through full 360-degree rotation. Thermometers may be installed vertically, or on right or left side of equipment.

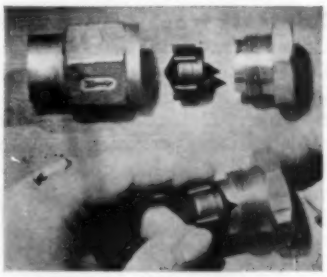
Precision Thermometer & Instrument Co.
Philadelphia, Pennsylvania

Circle 207 on Reader Service Card

FLOW CONTROL DEVICE . . . for water control

Designation: Mesurflo

Design: Device contains a rubber diaphragm which is expanded into machined grooves and hole of the brass orifice plate as pressure increases. Consisting of only four



components, the unit maintains a set rate of fluid flow regardless of variable inlet pressures. Units are available for ¼, ⅜, and ½-inch pipe sizes and can control flows from .2 to 8 gpm. Flow rates for hot or cold water are held to ±10% from 10 psi to 150 psi.

Hays Manufacturing Co.
Erie, Pennsylvania

Circle 208 on Reader Service Card

BELLOWS . . . for special applications

Application: Bellows are engineered for specific applications such as valve seals, expansion chambers, piston-type pumps, and cylinder rod

seals. Their resistance to surge and shock loading is desirable for use as accumulators and pressure sensing devices.

Design: Bellows can be supplied with neck, flange, or special end connections to suit the application. Factors in individual design and flexibility of stroke, effective area, size, internal and external pressure, service life, spring rate, operating

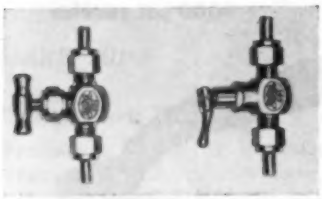
temperature, and vibration.

Specifications: Bellows can be produced with OD from 1¼ to 36 inches and an ID from ½ to 28 inches. Units have been produced for pressures as high as 2500 psi.

The Belfab Corp.
Agawam, Mass.
Circle 209 on Reader Service Card

VALVES
. . . feature simple installation

Features: Needle, toggle, and check valves permit elimination of pipe-to-tubing adapters or flaring tools. They provide for direct connection of the tube end to the valve



with a turn and a quarter of a wrench, resulting a torque-free, leak-proof seal. Valves can improve the design of graphic panelboards, instrument air lines, test panels, and pilot plant installations.

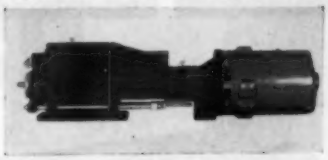
Hoke, Incorporated
Englewood, N. J.
Circle 210 on Reader Service Card

DIRECT-TAPPING UNIT
. . . eliminates tapping heads

Designation: Model 5-E

Features: Unit has rapid air-powered approach to the work and smooth hydraulic feed through at any pre-set rate desired. Spindle traverse is adjustable from zero to three inches; thrust is approximately three times applied air pressure. A broad differential in advance and retract piston areas provides thrust step-down for proper tap retract. Units may be mounted at any angle in any place for multiple operations.

Design: Tapping unit consists of a drill unit with a special, in-line, high-slip motor for 220/440, operation. Standard shaft speed is 1140 rpm, but other speeds are obtainable. Unit is furnished with a motor control cabinet containing a magnetic motor reversing contactor,



line overload protection, control transformer, and terminal strip.

The Bellows Co.
Akron, Ohio
Circle 211 on Reader Service Card

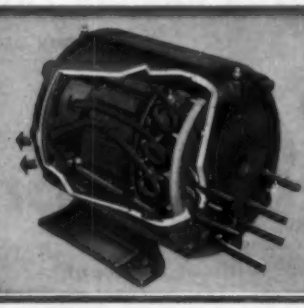
Continued on next page

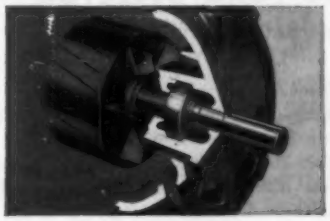
To HYDRAULIC ENGINEERS, Howell suggests

What to look for in Part-Winding Motors

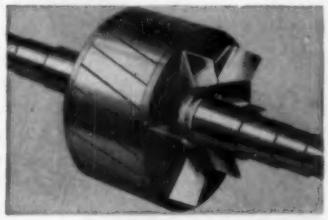
If you've investigated reduced voltage starting of centrifugal pumps, compressors, etc. with part winding (synchronous) motors, you know of the economies and efficiency to be gained.* But, as in other types of motors, manufacturers' constructions differ considerably. Below are some points for comparison . . . and a few of many reasons why Howell motors are so outstanding!

VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!





BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-wound rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

"Part winding motors reduce starting shock to machines, minimize line disturbances, and offer the advantages of low cost 2- or 3-step starters. A Howell motor specialist will be glad to show you their advantages (and limitations).

WRITE FOR BULLETIN P-84

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICH.
Precision-Built Motors for Industry Since 1915

HOWELL Red Band motors

Circle 16 on Reader Service Card

COMPACT DEPENDABLE EFFICIENT

Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS

It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

BHEW

Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.

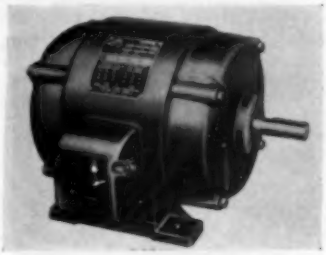
BENTON HARBOR ENGINEERING WORKS, Inc.

BENTON HARBOR, MICHIGAN

New Products continued

ELECTRIC MOTORS ... to new NEMA Standards

Features: Re-designed motors have better protection with a lower



air opening in the end-bell and a steel baffle plate. Dual cast aluminum fans provide double-end ventilation. These smaller frame motors provide greater horsepower in a smaller package with greater efficiency and a reduction in weight. Motors have double-width, prelubricated sealed ball bearings for increased, service-free life. Standard ratings are available in frame sizes 182, 184, 213, and 215.

Lima Electric Motor Co.
Lima, Ohio

Circle 212 on Reader Service Card

NEW! REPUBLIC SELECTOR VALVES NEW!

"LO-TEMP"
−65° without lubricant

LO-TORQ SELECTOR
BALANCED PRESSURE FOR EASY TURNING

With service pressure and seals on both sides of valving disk, turning is easy. Design is simple—maintenance is low. Many services—Air, and gas 4000 psi; fuel, hydraulic oil, petroleum, water, 6000 psi. Made in bronze, semi-steel, aluminum alloy, in three different portings, ⅛" to 1". Request Bulletin No. 454.

LO-TEMP SELECTOR

Teflon plug ends the need for lubricant. Easy turning—non seizing. −65° to 250°F. 2- 3- 4-way. 100 psi service. Made in aluminum alloy or stainless steel. ⅛" to 1" pipe or tube. Request Bulletin No. 754.

"LO-TORQ"
6000 psi service

145

RM

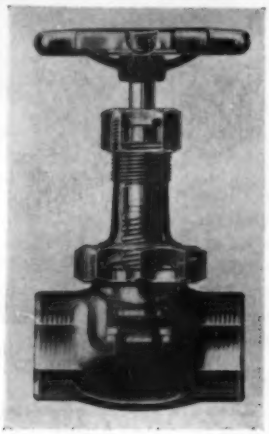
REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

BRONZE GLOBE VALVE
. . . for long-time service

Designation: LQ600

Design: Valve has record of long, trouble-free performance resulting from a new seating metal and a flat-seat design. New alloy is not surface hardened, but hard all the way through. It is more wear resistant than 500 Brinell stainless steel or 1000 Brinell case-hardened stainless steel. Flat seat design is practical with new alloy which can be fused permanently into the valve for its entire service life. Valve has simple external design with hand-



wheel which provides a comfortable, cool, firm grip even when hands are wet or greasy. Unit has durable, high-strength bronze in body and bonnet. True back-seating permits safe and easy repacking under pressure.

The Lunkenheimer Co.
Cincinnati, Ohio

Circle 213 on Reader Service Card

HAND PUMP
. . . for 1500 psi

Designation: Model H1601

Features: Pump has single-lever operation and provides accurate lowering control. The handle holder reverses for horizontal or vertical pumping action. Unit mounts with four bolts. Constructed of alumi-

num alloy, double-action pump has a capacity of 1.5 cu in per cycle. Pump has a plated piston and in-

Continued on next page

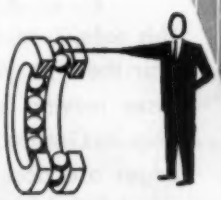
EMSCO
REG. U.S. PAT. OFF.

YOUR FIRST CHOICE

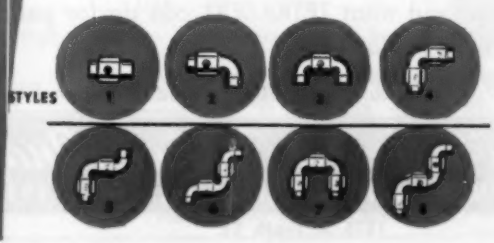
TYPE LPR BALL BEARING SWIVEL FITTING

extra years of SERVICE

Rig it up and forget it. EMSCO Ball Bearing Swivel Fittings are designed with built-in stamina for the toughest jobs, conservatively rated with an unusually high safety factor. Examine EMSCO Fittings — compare their easy turning quality. Compare the patented method of sealing against leakage. Compare prices. Regardless of the application, order EMSCO for your next job. You'll get years of extra service. TO ORDER: Simply state type of application, pressure, temperature, pipe size and desired ends.



THRUST BEARINGS FOR THRUST LOADS.



EMSCO

EMSCO MANUFACTURING COMPANY

BOX 2098, TERMINAL ANNEX
LOS ANGELES 54, CALIFORNIA
Garland, Texas • Houston, Texas

Representatives in principal cities

Circle 39 on Reader Service Card

New Products continued

corporates a positive check valve and quick release valve.

Specifications: Unit is 9 x 5½ x 7 in. and has an oil capacity of 150 cu. in. Pump weighs 9 lb and has ¼-in NPT ports.

Wisconsin Hydraulics, Inc.
Milwaukee, Wisconsin
Circle 214 on Reader Service Card

4-WAY SOLENOID VALVE
. . . provides safety features

Designation: Bulletin 8344

Features: Valve is power operated in both directions, eliminating springs. Unit includes only three moving parts reducing maintenance and increasing valve life. Dual solenoid valve locks into position on power failure. Seating is primarily metal-to-metal, reducing service problems connected with O-ring wear.

Specifications: Valve is capable of cycling at 850 times per minute for applications in punch presses,

welding machines, indexing operations, etc. Water-tight or explosion-proof enclosures are available. Dual-solenoid type is for pressures to 500 psi; single solenoid type is for pressures to 250 psi. Power consumption is 10 watts.

Automatic Switch Co.
Orange, N. J.
Circle 215 on Reader Service Card

TETRASEAL
RECTANGULAR-SECTION
RING
BY
GOSHEN RUBBER

this may be the SEAL for YOU

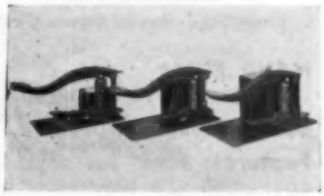
This safe, sure, low-cost seal may save you money and grief over the type you are now using . . . in static, and in some cases moving applications. TETRASEAL rectangular-section rings by Goshen are non-laminated (in one homogeneous piece). Edges are accurately formed, and cross-sectional tolerances can be held to ± .004 depending on inside and outside diameter, on size of cross-section and on material desired. Now available in materials to meet MIL, AMS and commercial specifications. To find out what TETRASEAL can do for you, write for Technical Bulletin No. 11.

See our "Facilities" catalog in Sweet's Product Design File.

Goshen Rubber Co. INC. Goshen, Ind.
CUSTOM DEVELOPMENT AND FABRICATION SINCE 1916
1575 S. Tenth St.

MANUAL PUMP
. . . for pressure to 6000 psi

Features: Foot-operated unit has two levers for applying and relieving pressure. Unit is self-contained with ample fluid reservoir in the



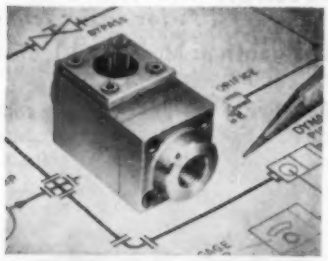
sump to keep the system clean. Pump has renewable check valve seats for easy maintenance. Pump is self-bleeding and air eliminating. Construction is of steel throughout. Made for 3000 psi with 48 cu in reservoir and for 6000 psi with 231 cu in reservoir.

Munton Manufacturing Co.
Franklin Park, Illinois
Circle 216 on Reader Service Card

PRESSURE PICKUP
. . . for differential measurements

Design: Unit consists of a flexible, pressure-sensitive diaphragm held in a rigid case and connected by a

rod to a special strain-sensitive resistance bridge. Separate input pressures are applied to each side of the diaphragm and the difference is translated through an electrical bridge circuit to an electrical output.



Application: Typical applications for the new differential pickup include compressor studies and use as a high precision flow meter in measuring the pressure drop across an orifice. Models are available with differential pressure ranges from 0-10 to 0-1000 psi.

Dynamic Instrument Co., Inc.
Cambridge, Massachusetts
Circle 217 on Reader Service Card

AIR FILTER
. . . for low volumes

Designation: Model 5

Features: Filter and dehumidifier has a maximum capacity of 5 scfm at 100 psi. Operating range is from

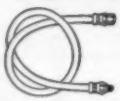
60 to 150 psi, and unit is recommended for instrument air lines or low volume pneumatic equipment. Filter removes all contaminants, including oil and water vapors and increases life of equipment.

Van Products Co.
Erie, Pa.
Circle 218 on Reader Service Card

Continued on next page

FLEX-O-TUBE ®

Supplied in Assemblies



Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

When you specify Flex-O-Tube for flexible lines you get the utmost in *dependability* as well as *bendability*.

Manufacturing facilities are keyed to precise production control. This means you can depend on Flex-O-Tube delivery dates . . . and that's mighty important when you're working against tight production schedules.

Every needed inspection and testing facility is on hand at Flex-O-Tube to safeguard the high quality standards of every product shipped. You can depend on Flex-O-Tube performance.

Dependable, too, is the engineering counsel we gladly extend when you're developing new flexible hose products. This engineering know-how is based on more than twenty years in the business.

If there's a flexible line in your product to conduct air or liquid, that has to be bendable, call in Flex-O-Tube . . . it's dependable.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.
Name .....
Company .....
City ..... Zone ..... State .....
Address .....

FLEX-O-TUBE
DIVISION OF MERIDAN CORP.
2527 JIM DALY ROAD • INKSTER, MICHIGAN
Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

Circle 27 on Reader Service Card

INVEST YOUR MONEY WISELY

Insure the safety of your product with a

"CLOVER CLOSURE"

Here are just a few of the many Clover Closures. We also specialize in individual requirements

METAL

Threaded caps for AN & SAE external threaded parts.

PLASTIC POLYETHYLENE

Tapered parts for use either as a cap or a plug.

METAL

Threaded plugs for AN & SAE internal threaded parts.

Send for Price Lists and Samples today

If you are looking for the best—buy from

CLOVER INDUSTRIES, INC.

578-588 Young St., Tonawanda, New York.

Manufacturers of both Metal and Plastic Closures serving industries needs since 1944

New Products / continued

SOLENOID AIR VALVE . . . for fast cycling

Designation: Model BVP-1, Model BVP-2

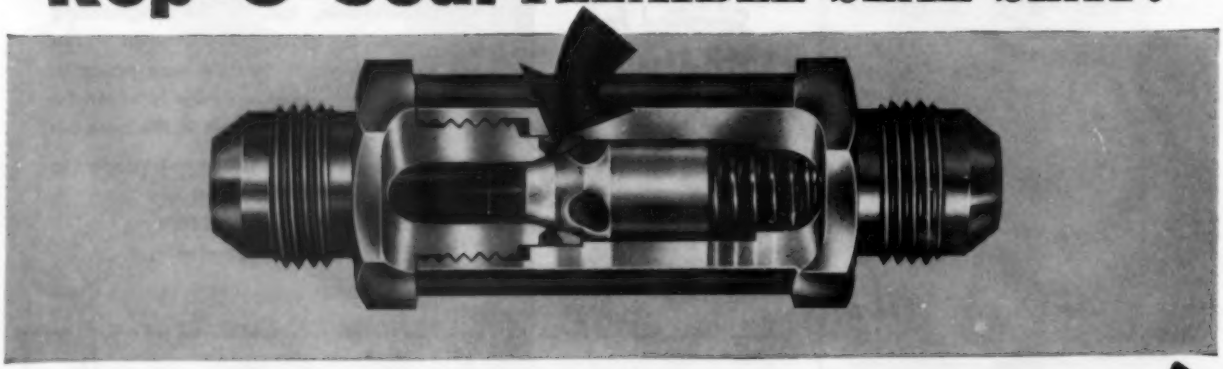
Features: Valve is extremely compact and capable of high actuation rates with short electrical signals.

Specifications: 3-way and 4-way valves are available for d-c voltages from 1.4 to 475 and a-c voltages from 3.6 to 750, with a-c frequencies of 25, 30, 50, and 60. Electrical outlets are ½-in. NPT conduit. Air ports are for ⅛, ¼, ⅜, ½, ¾, and 1-in. NPT sizes.

Beckett-Harcum Co.
Wilmington, Ohio

Circle 219 on Reader Service Card

Secret of Long Service Life... the Kep-O-Seal FLEXIBLE SEAL SEAT!*



Absolutely bubble tight! An ingeniously protected O-ring (see photo) securely seals internal *and* external leakage. Extremely simple design without complicated, costly precision-fit parts. Dirt can't bother Kep-O-Seal Valves because the flexible seal closes around offending particles; no danger of permanent seat damage. No pressure at threads, no leakage nor weakness there. Long-lasting original O-ring (no friction, no wear) when finally replaced at small cost, completely renews service life. Stocked in 6 standard sizes of Dryseal pipe and JIC tube, in 12 connection combinations. Send for illustrated data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

HYDRAULIC & PNEUMATIC

CHECK VALVES

***PATENT APPLIED FOR**

PLASTIC HOSE
. . . for air and oil

Designation: Type H-52

Design: All-plastic hose handles pressures up to 125 psi with an actual bursting pressure at 75° F of 600 psi. Either reusable or permanent hose fittings may be used.

Features: Hose is lightweight and extremely flexible. Highly impervious to oil, gasoline, water, chemicals, and abrasives. The smooth bore permits greater fluid flow without turbulence.

Application: For all regular air hose applications, especially for air tools and on production lines.

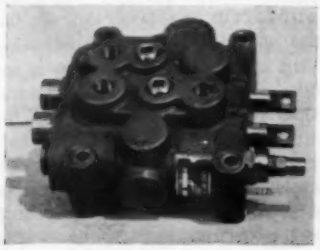
Specifications: Available in 3/16, ¼, ⅜, and ½-inch ID sizes it is packed in 100-ft. coils.

Hofmann Engineering Co.
Chicago, Illinois
Circle 220 on Reader Service Card

HYDRAULIC VALVE
. . . for mobile equipment

Designation: No. 3600

Features: For flow rates up to 60 gpm and pressures to 2000 psi. with construction, industrial, materials



handling, and special equipment. Provides for single and double-acting plungers with individual check valve for each operating plunger. Unit has adjustable relief valves, with or without float position, and alternate high pressure carry-over.

Hydraulic Unit Specialties Co.
Waukesha, Wisconsin
Circle 221 on Reader Service Card

with **UCON** Trade-Mark **Hydrolubes**
safety hydraulic fluids

Ucon Hydrolubes are a *combination* of ingredients blended in balanced proportions for maximum safety, maximum efficiency, and easy maintenance—a synthetic lubricant, water, effective liquid and vapor phase corrosion inhibitors, special anti-wear agents, and an anti-freeze.

All these components add their beneficial properties to give Ucon Hydrolubes remarkable advantages: fire-resistance that has been proved both in the laboratory and in 7 years' industrial use . . . no harmful effects on packings and seals . . . high viscosity indexes (150 to 160) . . . low pour points (below minus 55°F.) . . . no toxicity problems.

Ucon Hydrolubes are supplied in viscosities of 200, 300, and 550 S.U.S. at 100°F.—and others can be made. There's a Ucon Hydrolube to do *your* job.

Remember: **SAFETY** *is no accident . . . return the coupon today.*

UCON Trade-Mark Hydrolubes *are products of . . .*

CARBIDE AND CARBON CHEMICALS

CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC **New York 17, N. Y.**

Please send me the booklet "UCON Hydrolubes," Form 7380.

Name_____

Company_____ **Position**_____

Address_____

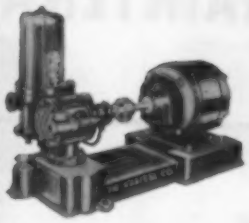
_____

"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.

• Since 1926 • In the application, design and manufacture—pumps, separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps • Vacuum Powered Transmission and Low Pressure Air Service • Air and Liquid Filters •



Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

Write today for Bulletin A-1289, for air-cooled pumps—and for A-1523 for the water-cooled models.

KRAISSL CO

305 Williams Ave., Hackensack, N.J.

Useful Literature continued

AIR VALVES . . . with built-in speed controls are described in Bulletin V-150 from Carter Controls, Inc. The balanced-type speed controls give a smooth action to air cylinders when operated at slow speeds with no significant reduction in power. The valves can be operated by solenoids, or can be manually or mechanically operated. The valves are available for all standard voltages and frequencies and can be furnished with explosion-proof and water-proof enclosures. All wearing parts are of stainless steel or nylon for long service.

Circle 147 on Reader Service Card

BUSHINGS AND BEARINGS . . . are detailed in two new brochures available from American Crucible Products Co. One of these is devoted to the company's bronze bushings, bearings and bar stock, and babbitt metal. Specific information on the company's babbitt metal including analysis and physical properties is included. The second brochure deals with cored and solid bronze stock with complete specifications as to mechanical sizes and weights.

Circle 148 on Reader Service Card

OIL FILTERS . . . for flow rates from 25 to 900 gpm are presented in Equipment Bulletin 101 available from Houdaille-Hershey of Indiana, Inc. The bulletin points out various applications of the filters and details design features which include simplified maintenance and rugged construction. Specifications and dimensions are given for six different models.

Circle 149 on Reader Service Card

FLOW METERS . . . and flow instruments are detailed in Catalog 2 issued by Fischer & Porter Co. Included in the catalog is a flow rate meter which is especially suitable for panel mounting. The meters are made for flow rates from .057 to 85 gpm and have a linear scale which is fused permanently into the tube. The meter float operates freely within the transparent glass metering tube which is enclosed in a strong, pressed-steel shell. End fittings are rotatable allowing for universal piping connections, and end plugs can be removed for easy cleaning. Deep stuffing boxes, with flanged packing glands which are adjustable from the outside, assure retention of fluid.

Circle 150 on Reader Service Card

AIR AND HYDRAULIC COMPONENTS . . . are reviewed in Bulletin IC-2.2 published by National Pneumatic Co. Inc. Ten different circuits are shown using the components of cylinders, valves, and hydraulic dampers manufactured by the company. The damper permits smooth control of air cylinders. The circuits illustrate arrangements for continuous cycle control, non-reciprocating control, and variations of these. Descriptions of valves including a pushbutton valve, relay valve, quick-exhaust valve, and foot-operated valve are given.

Circle 151 on Reader Service Card

PISTON RINGS . . . are the subject of a booklet available from Precision Piston Rings, Inc. Information about the construction and manufacturing processes of the rings is presented, and a discussion of the causes of ring failure is included. The booklet gives physical properties of eight alloys used for piston ring manufacture, and lists coefficients of friction between metals. The booklet also presents the factors of selecting piston rings for a particular application such as dimensions, shape, tolerances, etc.

Circle 152 on Reader Service Card

MOTOR CONTROL . . . U. S. Electrical Motors, Inc. has released a new full-color 8 page brochure, Bulletin 1882, detailing their variable speed control. The control con-

sists of a pneumatic amplifier composed of a "power" system and a "signal" system. The literature illustrates how the high pressure power system, controlled by the low-pressure signal system, operates a piston which moves the speed control lever. The speed control can be actuated by pressure, temperature, viscosity, flow rate, liquid level, electrical signals, and other quantities. Schematic drawings explaining the process are shown with each application.

Circle 153 on Reader Service Card

MACHINE DRAWINGS . . . which can be accurately scaled are made possible by the use of aluminum inserted drawing papers. Described in literature available from Geo-Optic Company, Inc., these papers have the extreme durability, resistance to climatic conditions, and dimensional stability needed for permanent drawings. Widely used for many years for mapping and surveying, now aircraft, automotive and machine industries are using these weatherproof papers for closely scaled layout and piping work.

Circle 154 on Reader Service Card

LIMIT SWITCHES . . . are the subject of a catalog which covers models including single-pole, double-throw; double-pole single-throw; three pole; and neutral position, double-throw. The limit switches, products of The R. B. Denison Co. are the heavy-duty type which incorporate an improved trigger trip mechanism. Lighter operating pressure, and a balanced, low-impact rotor with oilless bearing and only four rotating parts are features of the switches which also have 70 degrees safety overtravel and interchangeability of mountings and levers.

Circle 155 on Reader Service Card

AIR COMPRESSOR . . . Ingersoll-Rand presents their new 20-hp, air-cooled compressor in a pamphlet available from the company. Valve design in this compressor ensures longer valve life, and lower discharge temperatures. A flywheel-type fan forces large volumes of air across the intercooler tubes to remove heat of compression. The compressor has been designed for compactness with three cylinders

Continued on next page

MORE PAYLOADS PER DAY

with

GENERAL FUL-BORE

FUL-BORE Hydraulic Hose Assemblies and Union Adapters enable you to raise and lower the bucket faster—getting *more work per day*. A loader is only *one* example of how FUL-BORE insures faster actuation on all hydraulic equipment.

FUL-BORE means constant inside diameter throughout. No narrowing or restriction at the coupling.

Result: Maximum rate of flow with minimum turbulence, generated heat and pressure loss. Cylinders act in faster cycles due to increased flow and decreased power loss. This means more payloads and more profitable operation.

Get the engineering details. Write for new data book.

HOSE AND COUPLING CO.
409 Broad Avenue
Palisades Park, N. J.

SIZES

Intermediate	Standard
5/16	3/16
13/32	1/4
5/8	3/8
7/8	1/2
	3/4
	1

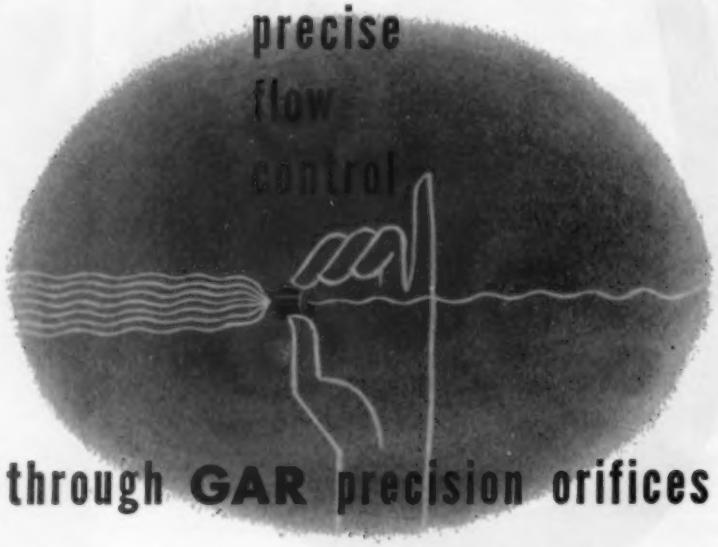
Useful Literature continued

for better balance and cooling. The compressors are rated for 40 to 250 psi in single and two-stage designs. The units may be either direct connected or belt driven.

Circle 156 on Reader Service Card

ELECTRICAL CONDUIT . . . A handbook of reference data on electrical conduit has been issued by Pittsburgh Standard Conduit Co. and designated as Bulletin RD-1. The 24-page booklet contains excerpts from the National Electrical Code, latest Federal Specifications, and Underwriters Laboratories Specifications, applying to conduit. Two pages are devoted to illustrating typical electrical symbols from the American Standards Association and two more pages to standard types of pipe bends. Tables give weights and dimensions of conduit and couplings, and specifications of elbows, and nipples. Other tables give conduit spacings, maximum distance for wire runs, current-carrying capacities, etc.

Circle 157 on Reader Service Card



through GAR precision orifices

*P*recision *Gar-formed* orifices, manufactured by Gar's exclusive *electroforming* process, account for the superior flow control of Gar hydraulic components. No other process gives such clean, sharp orifices, so precisely sized and accurately identical. That's why no other restrictors, valves, or similar units match Gar's uniform, predictable flow characteristics.

Along with superior orifice design and performance, you'll find other advanced features in Gar products. Self-cleaning operation, corrosion-resistant materials, and precision manufacture throughout mean components that easily meet strictest standards for performance and service.

When you specify Gar hydraulic components, you are assured the smooth, reliable, control that only Gar precision orifices can provide.

RESTRICTORS ★ REDUCING VALVES ★ RELIEF VALVES ★ FILTERS ★ SNUBBERS

To cover a full range of pressure and temperature ratings

Send today for full information GAR PRECISION PARTS, INC.
3 LUDLOW STREET, STAMFORD, CONN.

SEALS . . . with a rectangular cross-section are detailed in Technical Bulletin No. 11 offered by Goshen Rubber Co., Inc. The seals are for low-cost, leak-proof sealing of most static and some movable applications. The seals are of one homogeneous piece and cross-sectional tolerances are held to ±.004 inch or closer depending on the size and the material. The seals are available in materials meeting MIL, AMS, and commercial specifications.

Circle 158 on Reader Service Card

AIR FILTERS . . . are the subject of a brochure offered by Air-Maze Corp. The line of filters is designed for removal of water, oil, dirt and other foreign material from compressed air or gas at pressures up to 150 psi. Standard models are available for pipe sizes to 2 in. and special models can be furnished for pipe sizes to 6 in. Pressure drop across the filters does not exceed 3 ounces. The filters are designed for easy disassembly with a permanent type separator element which may be cleaned in hot water. A handy table is included in the brochure for simple computation of the correct size filter for a given installation.

Circle 159 on Reader Service Card

BEARINGS . . . are the subject of a new 140-page catalog published by McGill Manufacturing Co. The catalog includes more than 30 pages of general engineering data for ball and roller bearings including charts, drawings and formulas for bearing load computations. The catalog also has sections devoted to each model of bearing manufactured by the company with information for each model including dimensions, load capacity tables, mounting details, shaft and housing fits, and tolerances and drawings of typical applications. One section contains drawings of five seal combinations possible with a new type bearing.

Circle 160 on Reader Service Card

Continued on page 130

READER SERVICE CARD

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PLEASE SEND ME ADDITIONAL INFORMATION AND LITERATURE ON ITEMS CIRCLED BELOW.

1	18	35	52	69	86	103	120	137	154	171	188	205	222	239	256	273	290	307	324
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291	308	325
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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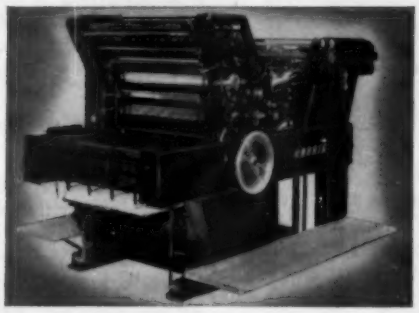
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

Circle 49 on Reader Service Card

GAST MODEL 10 X 1040 VACUUM PUMP.

●

At 26" vac., one sq. inch of vacuum cup area will hold 13 lbs.—one sq. ft. of vacuum cup area holds 1,872 lbs.



What GAST Air Pumps do on Printing Equipment may spark valuable ideas for your

AUTOMATIC MACHINES

Automation's an old story to printers! For years they've cut costs with equipment that performs multiple separate, consecutive operations automatically, like this printing press . . . or the paper folder . . . or collator.

For years too, dependable, efficient Gast rotary Air Pumps have been used on such equipment—providing suction to hold, lift or feed stock . . . pressure to float stock, blow powder, etc.

Perhaps *your* product would benefit with a Gast Rotary to perform similar functions—or to position, push, pull, suck, inflate, evacuate, aerate, or atomize? *For details on 35 actual applications, write for "Application Ideas" Booklet!* Gast Manufacturing Corp., P.O. Box 117-D, Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY
- AIR MOTORS TO 3 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

See Our Catalog in Sweet's Product Design File

Circle 115 on Reader Service Card

specify standard

UNBRAKO

PRECISION GROUND DOWEL PINS

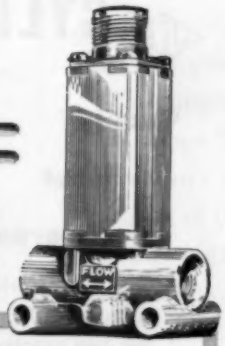
There's a cheaper and better way than the "make your own" method of filling your dowel pin requirements—the UNBRAKO way. Authorized industrial distributors stock a complete line of these precision products in diameters from 1/16" to 1" in a full range of lengths. Note these UNBRAKO *standards:*

Surface Hardness, Rockwell "C" Scale: 60-62
Surface Finish: 6 microinch maximum
Core Hardness, Rockwell "C" Scale: 50-54
Average Single Shear Strength: 150,000 psi
Diameter Tolerance: ±0.0001"

Ask your supplier for Bulletin 836. Or write STANDARD PRESSED STEEL Co., Jenkintown 2, Pennsylvania.

UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

MAXIMUM FLOW = MINIMUM WEIGHT



New Valcor Solenoid Valves . . . with the highest ratio of flow to weight of any Valve made. They are low in weight; low in pressure drop; low in power consumption; . . . and low in cost. No other Solenoid Valve but VALCOR is so completely depended upon in so many critical applications

SPECIFICATIONS:
Weight—1/3 lbs.
Ambient Temperature—minus 65° to plus 180° F.
Max. Leakage—½ cc/hr. fuel 10 cc/min. air
Current Drain — ½ amperes @ 24 V.D.C. Designed in accordance with MIL-V-8610 (ASG) and MIL-E-5009A

Valcor Valve Part No.	Type	Max. Operating Pressure
V-3800	Normally Open	200 psig
V-3900	Normally Closed	100 psig
V-6800	Normally Open	300 psig
V-8400	Normally Closed	200 psig
V-8500	Normally Open	300 psig
V-5000	Normally Closed	300 psig
V-8300	Normally Open	500 psig
V-7000	Normally Closed	500 psig

Write today for detailed information

VALCOR SOLENOID VALVES

Eastern Representative: East Coast Engineering Co. Roslyn Professional Bldg., Roslyn, N. Y.
Western Representative: Rowe Sales Co. 2140 Westwood Blvd., Los Angeles 25, Calif.

VALCOR ENGINEERING CORP.
CARNEGIE AVE., KENILWORTH, N. J.

PROTECT YOUR HYDRAULIC SEALS with the IMPROVED Seal-Guard® METALLIC ROD-WIPERS

Here is a BETTER WAY to insure long life for cylinder rod packings, bearings, machine spindles, guide pins.

Seal-Guard's flexible bronze, knife-edge wiping rings mould themselves to the shaft contour . . . peel off dirt and grime . . . lift it entirely away from the shaft—no packing or crowding under.

- No chance of fouled bearings or packing.
- Can't damage shaft surfaces.
- Seal-Guards are available to fit rod diameters from ½ to 10 inches. Other sizes by special order.

Write for descriptive literature.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

 Circle 127 on Reader Service Card

Circle 65 on Reader Service Card

Useful Literature continued

QUAD RINGS . . . their composition, specifications, applications and advantages are discussed in a folder issued by Minnesota Rubber and Gasket Co. The booklet completely describes approved methods for installing these hydraulic seals. One section is devoted to six typical applications, with all uses shown in photos and cutaway drawings. Another section describes packing gland design with illustrations and instructions for finding correct groove dimensions.

Circle 161 on Reader Service Card

SURGE REDUCER . . . An in-line accumulator which acts as a surge reducer is presented in Brochure A6-118.01 by Westinghouse Air Brake Co. The brochure shows a cross section of the construction of the surge reducer and gives data on several applications. Graphs of surges before and after installation of the surge reducer are shown to illustrate its advantages. The unit can eliminate maintenance costs which are a result of pulsations and pressure surges, and permits an increase in flow by reducing turbulences that retard the smooth flow of liquids. The reducer also protects hydraulic components which might be damaged by surges.

Circle 162 on Reader Service Card

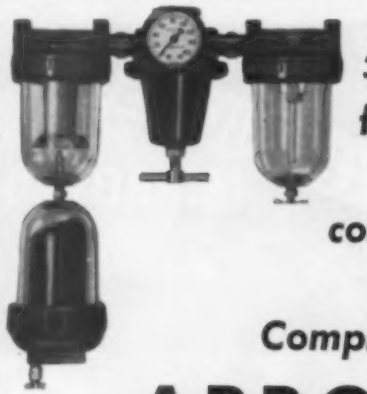
AIR VALVES . . . manufactured by Mechanical Air Controls, Inc. are presented in detail in Catalog 55 available from the company. The catalog covers solenoid valves, cam-operated valves, and pilot-operated valves. Sectional drawings and parts lists are given for each valve. Typical installations are diagrammed, and valves for unusual applications are listed. Test data is included in the catalog showing actual cylinder rod speeds obtained with one of the solenoid valves. A page of diagrams giving dimensions of manifold locations is included.

Circle 163 on Reader Service Card

FLUID POWER DEVICES . . . including cylinders, valves, and packaged units are presented in a leaflet available from Modernair Corp. Packaged units manufactured by the company include air filter units, small compressors, and power machine control. Various mountings of cylinders are shown including a co-axial, air-hydraulic cylinder and an inline air-hydraulic cylinder. The material also shows air exhaust mufflers and flow control valves.

Circle 164 on Reader Service Card

METERING VALVES . . . manufactured by Hoke, Inc. are presented in a leaflet from the company. For fine adjustment, the valve requires 20 turns of the handle to move the 8-degree needle point from open to closed position. The valves are designed for pressures to 2000 psi and temperatures to 150° F. The valves which are intended



ARROW

for control and conditioning of Compressed Air

ARROW

Autopneumatic Control Assembly or Individual Units

Filters—Lubricators—Regulators—Water Traps

Will reduce maintenance, repair and down time to the minimum for all Air Power Tools and Appliances.

- Pipe Line Sizes: 1/4", 3/8", 1/2", 3/4", 1" and large capacity.

Write for new CATALOG and Literature

ARROW TOOLS INC.

1902 S. KOSTNER AVE. CHICAGO 23, ILL.

Circle 10 on Reader Service Card

JLE CYLINDERS

Quality without compromise . . .

- The JLE "Work Horse" Cylinder line for air pressures to 110 psi, 250 psi hydraulic. Designed for our own exacting applications on wire machinery, is rugged and dependable. Available in four standard mountings, both cushioned and non-cushioned, in bore sizes 1½ to 10 in.
- The new JLE Square Cylinders for air and low pressure hydraulic service, are available in interchangeable stock mountings, fixed, automatic or adjustable cushions in bore sizes from 1½ to 16 inches.
- Engineering service available for all fluid power problems. Write us or contact your nearest authorized distributor.

Send for new JLE Cylinder Catalog HP 107

JAMES L. ENTWISTLE CO.

1475 Elmwood Ave. • Cranston (Prov. 7), R.I.

Circle 40 on Reader Service Card

for precise control of small flow rates are available for direct and panel mounting and can be furnished in ¼ and ⅛-in. pipe connections.

Circle 165 on Reader Service Card

VANE PUMP . . . for mobile applications is specified in Bulletin DP-320 offered by The New York Air Brake Co. The pump is designed for high speed direct engine drive, and can be operated continuously at 2000 psi and at maximum speeds from 2000 to 2600 rpm depending upon the size of the pump. The bulletin includes comprehensive selection data showing flow rates and horsepower input for four sizes of pumps at selected operating speeds. Also shown are a variety of mountings, shafts, port connections, and port positions.

Circle 167 on Reader Service Card

SOLENOID VALVE . . . is outlined in Bulletin 8030A prepared by Automatic Switch Co. The bulletin gives a general description of the valve pointing out that solenoids can be furnished for 10½ or 20½ watts and all solenoid enclosures can be rotated 360 degrees for ease of installation and electrical connection. Application data is given and diagrams show the operation of the valve. Charts are included to show pressure drop at various flow rates of water and air.

Circle 168 on Reader Service Card

HYDRAULIC PUMPS . . . Four models of gear pumps are detailed in Catalog 955 issued by Geo. D. Roper Corp. The H-Series pump which is included is designed to operate at pressures up to 1000 psi and handles from 5 to 75 gpm in various models. These pumps are available for pipe connections from ½ to 3 in. and have rated speeds of 1740 for the 5 gpm size, to 865 fpm for the 75 gpm size.

Circle 169 on Reader Service Card

RECIPROCATING BOOSTER . . . is featured in a new bulletin issued by Miller Fluid Power Co. The bulletin gives a detailed description of reciprocating booster operation and illustrates five circuits for its use. The circuits are a basic circuit with automatic pilot reciprocation, two rapid pressure build-up circuits for single and dual pressure with a single acting cylinder, and two slow pressure build-up circuits for single and double acting cylinders. Notes on the operation of these circuits is included, as are specifications for the boosters which have bores from 4 to 14-inches.

Circle 170 on Reader Service Card

AIR FILTERS . . . regulators, and lubricators are described in a 16-page catalog from Arrow Tools, Inc. The components perform thorough filtering and lubrication of compressed air and remove up to 98% of free moisture with automatic removal of trapped condensate. Various combinations of the units and their features and applications are discussed with photos and diagrams. Performance charts are given showing pressure drop for various air flows, and typical installation arrangements are indicated.

Circle 171 on Reader Service Card

New booklet describes advantages of Superior hydraulic quality tubing

Tubing is the modern, efficient method of handling fluids. Because it saves space and weight and is easily bent and flared, the number of fittings required is reduced and so are installation costs. In addition, it offers tighter joints, greater strength, and less pressure drop.

Seamless hydraulic tubing has been a SUPERIOR speciality for many years. From the melting of the steel to the final flare testing of the finished tube, the production of SUPERIOR low-carbon tubing is a quality operation. Tubing is given a 100% hydrostatic test at pressures which raise the fiber stress to 15,000 psi—in many sizes well above the 1000 psi minimum required by SAE-JIC specifications. Carbon content is held to .12% maximum for greater ease of bending and flaring, and each order is tested for flareability. The steel used is of a non-aging type made under a special melting process to insure low yield strength and unusually high elongation. Sizes range from ⅛″ to 1⅛″ OD.

Complete information concerning SUPERIOR HYDRAULIC tubing, including maximum working pressures, bursting pressures, velocity and flow charts, etc., is contained in a new booklet, shortly to be published. Use the coupon to obtain your free copy, testing samples—and the name of the SUPERIOR distributor nearest you. On the West Coast, write Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif.

SUPERIOR TUBE COMPANY
2030 Germantown Ave., Norristown, Pa.

☐ Please send me a free copy of Bulletin 39 on Superior Hydraulic Tubing as soon as it is released.

☐ Send me a free sample of hydraulic tubing ″ OD and ″ wall to be used for_____.

☐ I would like to know the name of the distributor nearest me.

Name.....
Title.....
Company.....
Street.....
City.....Zone....State.....

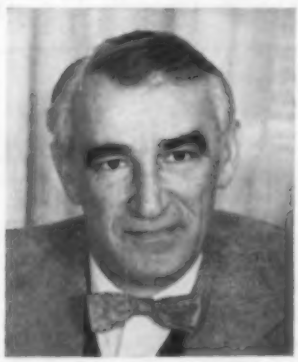
Circle 118 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Ludwig T. Stoyke
Lear-Romec Div., Lear, Inc.

Elbert M. Gage
Teer, Wickwire and Co.



Robert P. Lord
Greer Hydraulics, Inc.

Lear-Romec Division of Lear, Incorporated has named **Ludwig T. Stoyke** manager of the hydraulic engineering department. He will now be in charge of the design, development and testing of all aircraft high-pressure hydraulic pumps, fuel pumps, constant speed transmissions and other hydraulic equipment. He was previously assistant chief engineer at Sundstrand Hydraulic Division of Sundstrand Machine Tool Company.

Elbert M. Gage, president, Teer, Wickwire and Company, Jackson, Michigan, announced the company's purchase of the **Lindberg Air and Hydraulic Cylinder Division** from Lindberg Engineering Company. The new operation will be set up as **Lindberg Air and Hydraulic Division of Teer, Wickwire and Company.** The purchase covered the entire stock, machinery, designs and development work of the Lindberg Division. The entire field sales organization was also taken over as part of the transaction.

A board of directors meeting of **Greer Hydraulics, Inc.,** has approved new corporate titles and functions for three members of the company's executive staff. **Robert P. Lord,** formerly secretary-treasurer, has become executive vice president and treasurer. **David Fromson** was named secretary, and controller **J. Stanley Crum** has been elected an officer of the company.

Mr. Worswick has been appointed chief engineer of **Towler Brothers (Patents) Ltd.,** Rodley, England. He was previously chief designer of the Press Division of Foster Yates & Thom Ltd.

The newly created position of general sales manager of the industrial division of **Chain Belt Company** has been filled with the appointment of **George H. Woodland.** He joined the organization in 1938 and until his recent promotion was manager of the industrial field forces.

John J. Dempsey, formerly chief development engineer for **Servomechanisms', Inc.,** Eastern Division, has been appointed division manager for the company's Components Division.

H. A. Wiley, Jr. has become manager, belting and packing sales of **Quaker Pioneer Rubber Mills,** Division of H. K. Porter Company, Inc. With the company since 1950, Wiley will now coordinate the factory and field activities.

Bruce W. Thomas has been promoted to Eastern district manager of Rubber and Packing Divisions, **Raybestos-Manhatten, Inc.** He will supervise sales in the

Circle 113 on Reader Service Card

A two-position, 4-way valve for air or hydraulic fluids at pressures to 100 psi and vacuum to 25".

FEATURES:

Leak free operation. Low cost. Low handle torque. Low pressure drop. Easy panel mounting. Corrosion-resistant materials—bronze, aluminum. Simple maintenance—disassembly without disconnecting lines.

SPECIFICATIONS:

1. Fittings—Model S-576 for ¼" tubing port connections per AND10056. Model S-576-1 for ¼" female pipe thread port connections.
2. Weight 6 ounces.
3. Seals—standard commercial "O" rings.
4. Finish—black anodized.
5. Size: 3¾" wide by 2⅝" deep, including handle.

For complete information, send for Bulletin 3000.

SPRAGUE *Engineering Corporation*

1144 WEST 135TH STREET, GARDENA, CALIFORNIA

FOR CLEAN, DRY AIR

Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER
Sizes: ¼, ⅜, ½, ¾; Weight 30 lbs; Pressures: 0 to 125 psi:
Price: $71.00 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

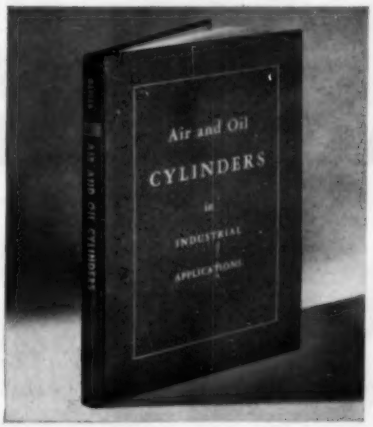
Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

JAS. A. MURPHY & CO. INC.

Hamilton, Ohio

AIR and OIL CYLINDERS in INDUSTRIAL APPLICATIONS



Design and production men who have this book are saying . . .

"A fabulously rich mine of practical information."
"Admirably down to earth."
"Certainly the most readable book devoted to the subject of pneumatic and hydraulic power cylinders."
"Will interest the maximum number of readers."
"Theory and technical explanations are clearly and concisely presented."
"The essence of the book is that it manages to be at one and the same time forceful, amusing, easy on the brain and, not least, a valuable treatise on a little documented subject."

These are the reasons why an increasing number of copies are now being sold as repeat orders.

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Post Scripts of Industry
continued

New England, New York, and Philadelphia territory, with headquarters in Philadelphia. **John McKinlay,** promoted to special representative for the divisions with headquarters at Manheim, was previously in Chicago territory.

Blair-Martin Company, Inc., S. Pasadena, have been named by **Smith-Nelson Corp.,** and **Air-Dry Corporation of America** to act as their sales representatives in southern California and Arizona.

ACCEPTED...

The accepted standard in protective metal closures for aircraft hydraulic lines and components originated with Tubing Seal Cap, Inc., over fourteen years ago.

SEND TODAY for new 1952 ILLUSTRATED CATALOGUE and PRICE LIST

TUBING SEAL CAP, INC.
808 WEST SANTA ANITA
SAN GABRIEL, CALIFORNIA
EASTERN OFFICE
428 NEW CENTER BLDG.
DETROIT 2, MICHIGAN

John G. Henrikson has taken over the direction of the **Graton & Knight Company's** sales department, succeeding Elliott C. Paddock who has retired. **Homer LaRue,** formerly field sales supervisor who also served in the export department, has become assistant sales manager. Henrikson has been with the company since 1917

John G. Henrikson
Graton & Knight Company

Homer LaRue
Graton & Knight Company

and LaRue who has been associated with G & R for 40 years, has been selling the firm's products in India, China and South Africa.

Ford Instrument Company, Division of the Sperry Corporation has appointed **Harold M. Niles** as manager of Navy contracts and **Roy Schoenhaar** as assistant chief draftsman.

The name of the Alpha Corporation was changed to The **Alpha Molykote Corporation.** According to **Alfred Sonntag,** president,

the change in name was made to reflect the primary activity of the organization which develops, manufactures and sells industrial lubricants known as Molykote.

Joe D. Robertson has been named as sales representative for the **Watson-Stillman Company,** Division of H. K. Porter Co., Inc. His territory will include North and South Carolina, Georgia and several counties in Florida.

G. W. Van Cleve has been named vice-president and general manager of **Allied Scientific Products Co.,** Culver City, Calif. Van Cleve will continue as sales manager of Stillman Rubber Co.

G. W. Van Cleve
Allied Scientific Products Co.

The Bristol Company of Waterbury has named **D. J. Yates** as field representative on the West Coast. With the Bristol sales organization since 1945, Yates will work from his headquarters in Los Angeles.

To accommodate up to 1000 engineers, **Lockheed Aircraft Corporation** plans to construct a new one million dollar engineering office building, a "drawing board laboratory", for advanced flight studies. To be built adjacent to the company's jet assembly plant, the building will provide 105,000 square feet of floor space. Completion of the one-story brick-and-steel structure is scheduled for fall.

NEW BACK PRESSURE RELIEF VALVE...

SHUTS OFF TIGHT

WITH PRACTICALLY NO PRESSURE DROP BELOW RELIEF SETTING

EXTRA LARGE CAPACITY

For Pressures From 0 to 400 Pounds P.S.I.

Chatter Free • Low In Cost • Unusually Sensitive

- Available in iron, bronze, monel or stainless body. Size ½ to 2" inclusive, with bronze, monel or Neoprene diaphragm.
- Suitable for use on practically all fluids and gases. Especially suited for oils of all grades, including Bunker "C".
- For additional information on Type FR, and other new automatic valves in the Cash-Acme line, write our Engineering Department at the address below. To avoid delay, please include a brief outline of your pressure conditions and requirements.

Cash-Acme's Type FR back pressure relief valve automatically maintains correct pressure on the inlet side, by relieving into a lower pressure line. It is not affected by pressure variations on the discharge side. Provides protection against periodic high pressure conditions. Can be used with modification as a differential pressure regulator—holding a constant difference in pressures between valve inlet and valve outlet. Valve action is fully floating for smooth and even control. New patented "Floating ring" is unusually sensitive—gives exceptionally good closure. Large capacity in almost frictionless performance.

CASH ACME

A. W. CASH VALVE MANUFACTURING CORP.

6629 E. Wabash Avenue Decatur, Illinois

The Complete Cash-Acme Line Includes Pressure Reducing and Regulating Valves, Relief Valves, Back Pressure Valves, Vacuum Regulators and Vacuum Breakers, Differential Pressure Regulators, Strainers, Diaphragm Control Valves.

I—5-55

Circle 70 on Reader Service Card

HYDRAULIC PUMP TEST STAND

Designed, Engineered, and Built by

INDUSTRIAL ENGINEERING CORPORATION

The Test Stand illustrated automatically breaks in and calibrates hydraulic pumps. They are subjected to a series of different pressures at predetermined time intervals. One operator can test six pumps simultaneously using three such stands.

I.E.C. also produces special control valves with which time of response and speed of control can be obtained in most cases with speed approaching 1/2 second. Flow ranges are from 5 to 300 GPM.

Send For Bulletin 541

INDUSTRIAL IEC ENGINEERING CORP.

INDUSTRIAL ENGINEERING
Corporation
525 EAST WOODBINE—LOUISVILLE 8, KY.
Phone: MAgnolia 2446

Post Scripts of Industry
continued

A. W. Cash Company has appointed **John A. Wiedman** as director of research and development. Wiedman, a graduate of Drexel Institute of Technology, was formerly assistant director of research and development at Minneapolis-Honeywell Valve Division.

John A. Wiedman
A. W. Cash Company

CLAMP YOUR WORK *HYDRAULICALLY!*

This folder shows how to *SLASH ASSEMBLY TIMES*

Simple • Inexpensive Instantaneous for
MILLING • GRINDING
WELDING • GLUEING
and every Clamping Problem

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VALETTA RD. · ACTON · LONDON · W.3

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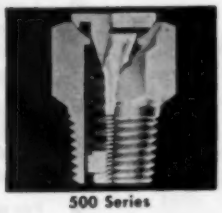
1060

Continued Progress in Valve Efficiency

***now*— A COMPLETELY RELIABLE**

RELIEF VALVE!



500 Series

- Doesn't leak
- Reseats dead tight
- Doesn't stick

Send for information today..... ☐

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CIRCLE SEAL *precision valves*

Representatives in Principal Cities.

JAMES•POND•CLARK
2181 East Foothill Boulevard, Pasadena 8, California

Circle 101 on Reader Service Card

Circle 71 on Reader Service Card

Ed Pickett has become district sales supervisor for all **Graton & Knight Company** products sold in the south-eastern United States. He will also direct sales of the company's two subsidiaries, International Packings Corporation and Dixie Leather Corporation.

Acquisition of the **Chiksan Company** by **Food Machinery and Chemical Corporation** was recently announced. **James L. Emerson** was appointed to the newly created position of assistant to manager of Chiksan's sales development department, and **Albert E. Plomp** has joined **Chiksan of Canada Ltd.** as a senior salesman.

James L. Emerson
Chiksan Company

Albert E. Plomp
Chiksan of Canada Ltd.

I. L. Ashkenas has been named chief engineer of **Control Specialists, Inc.** Inglewood, California. Also announced was the election of **A. P. Henry** as vice president. Ashkenas was formerly chief of the aerodynamics department of Northrop Aircraft Company, and Henry has been associated with Ford Instrument Company.

Hydraulic Units, Inc., Pasadena, California, has been purchased by the **Ronson Corporation.** As a wholly owned subsidiary of Ronson, Hydraulic Units, Inc., will be afforded much greater working capital to continue its expansion. **Byron D. Gilmore,** president and **Harry E. Johnson,** vice president, will continue in active management as officers of Hydraulic Units, Inc.

The Bellows Company has appointed **J. James Mudd** as assistant manager of field engineers and sales. Mudd, who joined the organization in 1945, recently served as Midwest regional manager.

J. James Mudd
The Bellows Company

TRADE MARK
"FULFLO"
REG. U.S. PAT. OFF.
VALVES
BY-PASS, OIL-RELIEF
PISTON TYPE,
HYDRAULIC

STANDARD AND FLANGE MODELS

NON-CHATTERING
because the cylindrical piston closes off the port in a shearing manner . . . and does not seat abruptly against the body of the valve.

EXTREMELY SIMPLE
Just select pressure desired from 5 springs . . . INSTALL . . . NO FURTHER ATTENTION NEEDED.

FOR machine tool hydraulic mechanism, oil-burning equipment, rams, presses and Diesel engines.

Pressures: 0 to 500 lbs.
Pipe sizes: 1/4" to 2"
Bodies: cast iron or brass.
Pistons: brass, hardened or stainless steel.

WRITE—on your letterhead, please—for personal copy of
FULFLO MECHANICAL DATA BOOK. Specify if for Valves, for Pumps or for both.

FULFLO
THE FULFLO SPECIALTIES CO. Inc.
PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

Post Scripts of Industry

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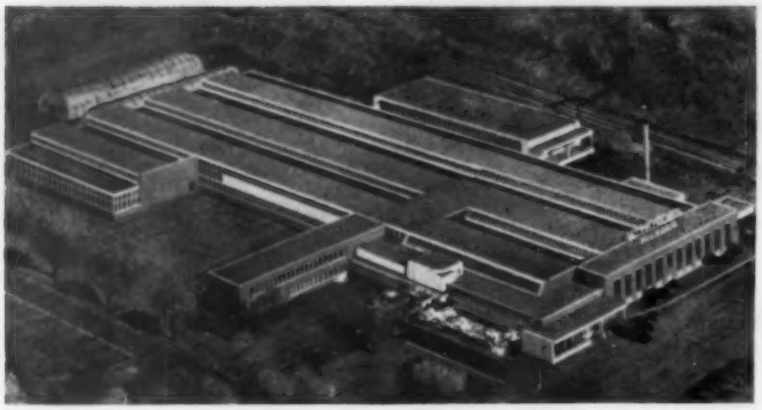


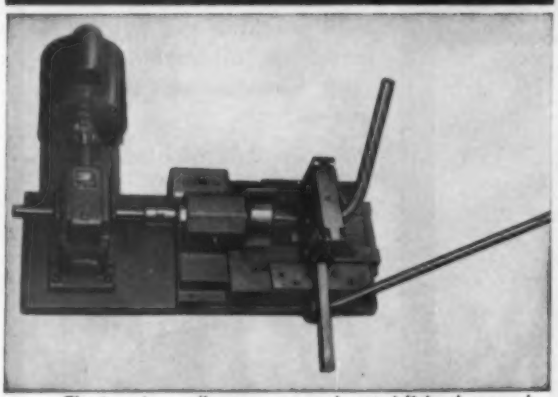
U. S. Electrical Motors Inc., announced the plans for the expansion of its Atlantic Plant at Milford, Connecticut. It is planned to increase the manufacturing floor space of the facilities, which were originally built in 1940, by 63,000 square feet. Located on 65 acres of landscaped grounds, the plant will have a total area of over 200,000 square feet of modern factory and offices. There will be no interruption of manufacturing during the expansion.

Three promotions have been announced by **Parker Appliance Company. Kenneth E. Jenkins** was named to the new position of district manager of Eastern Canada. He was formerly sales manager of the Industrial Hydraulics Division. **Harold E. Lewis** has been moved into this position, after heading the company's hydraulics training program for district managers and sales engineers. The newly created post of assistant sales manager of the Industrial Hydraulics Division has been filled by **R. D. Beatty, Jr.**

Superior Tube Company has acquired **Johnson & Hoffman Manufacturing Corporation,** Mineola, N. Y. **Jay H. Johnson,** president and **Eugene J. Hoffman,** vice president will continue in direct charge of Johnson & Hoffman's operations.

Al Xander Co., Corry, Pa., has been appointed O-ring distributor

"POWER-FLARE"



Flaring by roll process and established speed, the "Power-Flare" machine has greatly improved the flare of all types of tubing used in hydraulic systems.
It gives a smooth, always uniform, surface for seating; the metal is not work hardened near the danger point; and by creating a burnished surface, tool marks, scratches and burrs are eliminated.

One size machine flares steel, copper, aluminum and stainless steel from 3/8" OD. to 2" OD. Dies for 30, 37 and 45 degree angle fittings are available.

Numerous users have expressed complete satisfaction. "Power-Flare" has been proven in the field for over five years.

Immediate delivery.

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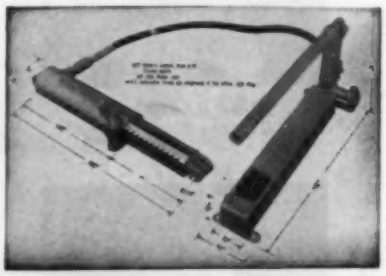
3022 E. Canfield, Detroit 7, Mich., Phone WAlnut 1-3094



HYDRAULIC SAFETY LATCH RAMS

(PATENTED)

"Hydro-Latch" Remote Control Hydraulic Rams of capacity or size to meet any requirements with built-in spring loaded safety latch, self-engaging as the ram travels out—either clevis or flange mounted. The rams will not rotate. Manually or mechanically operated. Standard size: 10 tons, 7 inches of travel. We solicit inquiries to fit your application.

WILLIAM S. PINE

1635 E. 22nd St., Los Angeles 11, Calif.

Circle 30 on Reader Service Card

Circle 100 on Reader Service Card

for Parker Appliance Company. The firm will cover northwestern Pennsylvania, northeastern Ohio and southwestern New York state.

The board of directors of **National Pneumatic Co., Inc.,** and **Holtzer-Cabot Divisions** have appointed **John R. Newkirk** as vice chairman of the board; **Richard H. Frost,** president; **Harvey J. Finison,** executive vice president; **J. J. Anderson,** vice president and general sales manager;

Richard H. Frost
National Pneumatic Co., Inc.

J. J. Anderson
National Pneumatic Co., Inc.

and **Robert Frost,** vice president for marketing. **Charles Frost** continues as chairman of the board.

Paul W. Norris has become vice president and director of sales of **The Denison Engineering Company. W. C. Denison,** president, in making the announcement said that Norris will supervise and be responsible for all domestic sales, advertising, service and sales promotional activities. Norris joined Denison in 1934 as an assembly mechanic and service engineer and had experience in

Paul W. Norris
The Denison Engineering Co.

the company's various departments. In 1951 he served as acting deputy director in the Metal working Equipment Division at the Department of Commerce, National Production Authority.

Present milling capacity of the **Berea Rubber Company** is being doubled with the installation of new equipment and the addition of 2200 square feet of floor space which provides for more stock compounding and mold repair facilities.

new! ADVANCED ENGINEERING FEATURES

new! EXTRA-HIGH FLOW RATES

new! QUICK OPENING LIDS

announcing

A COMPLETE NEW LINE OF HONAN-CRANE

OIL FILTERS

. . . the first in a series of important engineering developments by the NEW Corporation . . . HOUDAILLE-HERSHEY OF INDIANA, INC.

FULL FLOW—For in-line installation at high flow rates—25 to 800 GPM. Low pressure drop—only 4 PSI across unit at 170 SUS. Uses new "FLO-PAC" pleated paper cartridge permitting full flow of oil—removal of particles down to one micron.

MULTI-CARTRIDGE Eleven sizes to choose from with six different types of cartridge filter elements to give exact degree of filtration needed. New "FLO-PAC" and "KLEER-PAC" cartridges have large dirt holding capacities.

BULK REFILL—For absolutely clean oil—bulk Cranite filtering medium provides thorough depth type purification, removing all solids and products of oxidation in solution. Bulk or cartridge type cellulose refills available for fine filtering.

ALL MODELS HAVE QUICK-OPENING LIDS

Purifier lid is fastened with swing bolts which one man can loosen quickly. Lid swings back for easy access to refills.

Write for engineering bulletins and quotations on all three models.

HH

HOUDAILLE-HERSHEY OF INDIANA, INC.
FILTRATION DIVISION

102 WABASH AVENUE, LEBANON, INDIANA

Post Scripts of Industry
continued

To bring all phases of operations under one roof, **The Rucker Company,** Oakland, California, has moved into its new building. The modern structure covers 21,000 square feet of floor space and provides expanded fabrication and warehousing facilities.

The United States Hoffman Machinery Corporation has purchased the **Intercontinental Manufacturing Company, Inc.,** of Dallas, Texas. Intercontinental operates two plants, its main plant in Garland and the other at Brady. The company will continue to operate under its executive vice president **Ray Shape.**

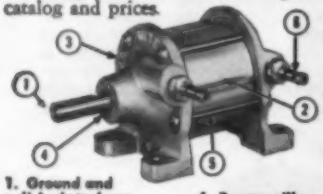
The Webster Electric Company has added **Jack R. Fehrenbach** and **Alan Mielke** to the sales staff of the Oil Hydraulics Division. Fehrenbach, who was previously associated with the Barksdale Company, will represent the company in the states of Indiana and Michigan. Mielke, formerly affiliated with the Nash Division of American Motors, will serve in the home office as sales and production coordinator.

Ozone Metal Products Corp., has announced the following appointments: **James A. Stadler,** vice president and general manager; **Edmund D. Holland,** vice president; **John F. Ceccarelli,** landing gear engineer; and **Vincent A. D'Aprile,** sales engineer. **William E. Crisley** continues as sales manager.

AIR-MITE AIR CYLINDERS

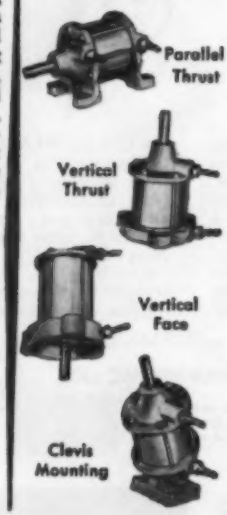
Low Cost . . . Compact . . . Powerful . . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE Devices, Inc.

4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

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Gresen

HYDRAULIC CONTROL VALVE

(Directional)

Model S.P.

- For Single or Double Acting Cylinders
- Pressures to 1500 PSI
- Built-in Adjustable Relief
- Ball Checks
- Openings—1/2" cylinder ports, 3/4" inlet and outlet.

Write for literature

GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. A-55 Minneapolis 11, Minn.

Circle 55 on Reader Service Card

The promotion of **Arthur B. Warner** to chief engineer of **Minnesota Rubber and Gasket Company,** was Warner's second advancement within eight months. In October, 1954 he became factory superintendent after serving as assistant plant manager.

Arthur B. Warner
Minnesota Rubber & Gasket Co.

The Webster Electric Company has added **Robert W. Butler** to the sales staff to coordinate sales to government agencies and branches of the military service.

MARKET PLACE

HYDRAULIC SALES ENGINEERS
Experienced in Industrial Hydraulic Sales
Excellent Salaried Opportunity
Territories in Mid-West and New England
Address Replies:

Sales Manager—Hydreco Division
The New York Air Brake Company
1100 E. 222nd St., Cleveland, Ohio

INTERESTED IN A
SALES ENGINEERING JOB
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Nationally known manufacturer of hydraulic and pneumatic cylinders, presses and valves has additional openings for men between 30 and 40 with machine design, tool engineering, plant engineering or related experience, who have a real desire for sales work. No insistence upon previous sales experience—a good education and practical experience preferred. Excellent starting salaries and fine futures for good men. Write in detail to Box 7255, APPLIED HYDRAULICS.

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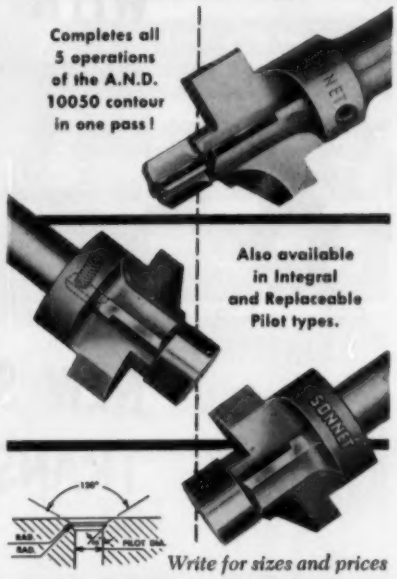
Sonnet A.N.D. 10050 Port Contour Cutter
now available in a NEW Replaceable Reamer Type


Completes all 5 operations of the A.N.D. 10050 contour in one pass!
Also available in Integral and Replaceable Pilot types.
SONNET

Write for sizes and prices

SONNET TOOL and MFG. CO.
571 No. Prairie Avenue • Hawthorne, California

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If it's a pressure gauge or dial thermometer, Marsh makes it . . . and makes it better. The types, ranges and case styles are endless. What is "special" to other instrument makers is often standard to Marsh. To know the scope of Marsh instruments—

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Hoke toggle valves open and close with a single, positive motion like flipping a light switch. Use them on your precision test equipment for gas or liquid control at pressures up to 1000 psi. Seat and stem seals are tight enough for most vacuum work.

In instrument panel service you can tell instantly that the valve is open (or closed) and the colored nylon handles identify fluids at a glance.

Available in angle and globe patterns in brass or stainless, 1/8" through 1/2" pipe (or with tube fittings).

May we send you catalog and data sheets?

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Fluid Control Specialists
187 S. DEAN STREET, ENGLEWOOD, N. J.

SAVE YOUR DESIGN TIME WITH THIS

NEW STANDARD TRANSFER

Sealol Fluid Transfers can solve the age-old problem of transferring pressurized fluids from a stationary source to a rotating part. They are easily adapted to equipment handling oil in power cylinders and clutches, as well as delivering coolant to oil-tube and gun drills.

Standard Sealol Fluid Transfers, capable of handling pressures ranging to 1000 psi, and shaft speeds to 10,000 RPM, *are now available*. Attachment is simple and Sealol Fluid Transfers are readily adapted to the user's equipment. Positive, leak-tight sealing is assured by the designed-in Sealol balanced pressure face-type seals.

Sealol welcomes the opportunity to help you with your fluid transfer problems — standard or special. Send data for engineering recommendations.

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THE ▲ BALANCED PRESSURE SEAL

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A Shock-absorbing bumpers cushion stroke, assure longer service life.

B Silicon steel laminations give high efficiency.

C Tempered steel spring absorbs vibration — holds assembly firmly in alignment.

D Hardened beryllium-copper plunger guide reduces friction and wear.

E Heavy Formvar insulated magnet wire on high flow point molded nylon bobbin.

Decco INDUSTRIAL SOLENOIDS

Built better for longer service.
Shock mounted to reduce self-destruction.
Designed to meet J. I. C. specifications.
Four to twenty pounds—push or pull.
Stroke to one inch maximum.
A. C. or D. C. models.

Special solenoid problems engineered to meet your needs.

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SEND your specifications for hydraulic cylinders to American, specialists in hollow boring and honing. We manufacture from tubing or forgings in carbon or alloy steels up to 15" I.D. Over 40 years experience backed by precision machines and skilled craftsmen will save you time and money. Send your blueprints.

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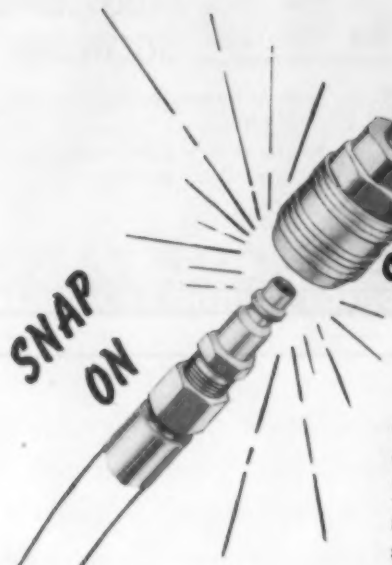
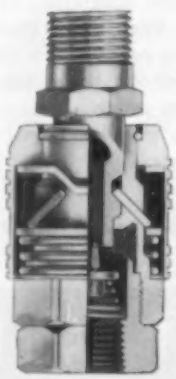
1954 RASPBERRY STREET • ERIE, PA.

SPECIALISTS IN THE MANUFACTURE OF HYDRAULIC CYLINDERS

NEW "HI-LO" SPEED COUPLERS and CONNECTORS

(HIGH VOLUME — LOW PRESSURE DROP)





"HI-LO" for *highest* air volume, *lowest* pressure drop

Better efficiency, lower operating costs for all air-operated devices.

Easy to use—snap on and off.

Swivel action saves wear on hose.

Wide selection of sizes for greater range of uses.

Leak-proof seal.

Interchangeable with many other brands of couplers and connectors.

Write for bulletin No. 5518T.

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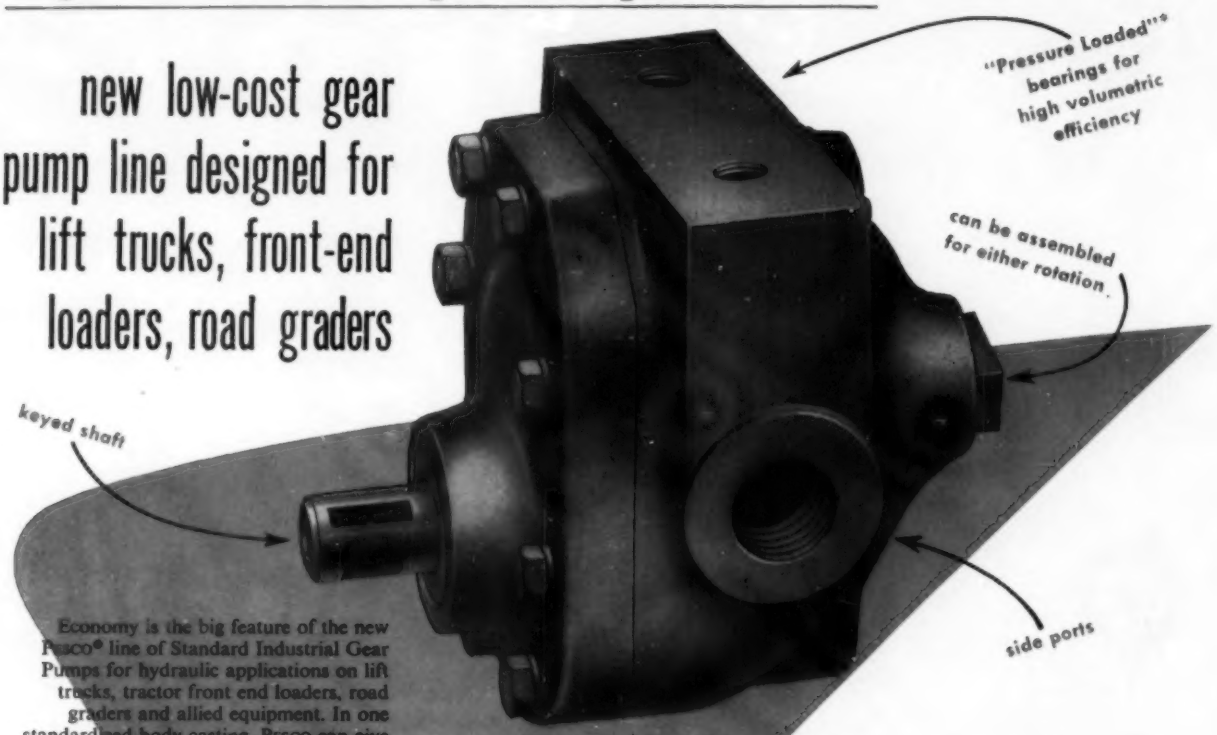

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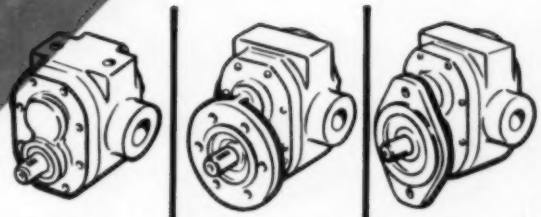

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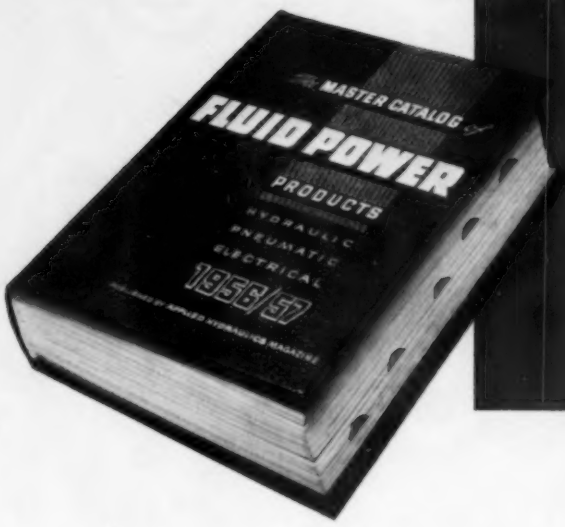

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